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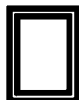
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VOLUME I OF III

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

TECHNICAL MEMORANDUM 1

BELOIT CORPORATION
BLACKHAWK FACILITY
ROCKTON, ILLINOIS

JULY 1993

PREPARED FOR:
BELOIT CORPORATION
ROCKTON, ILLINOIS

...

PREPARED BY:
WARZYN INC.
MADISON, WISCONSIN

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JUL 06 1993

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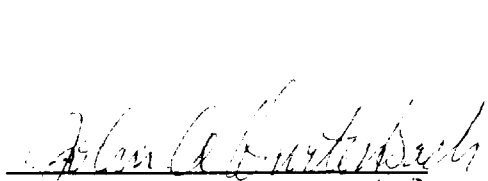
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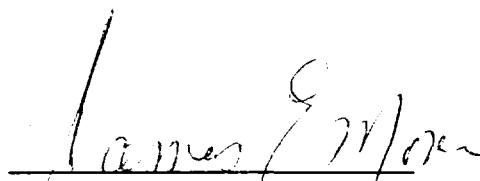
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BELOIT CORPORATION
BLACKHAWK FACILITY
ROCKTON, ILLINOIS

JULY 1993


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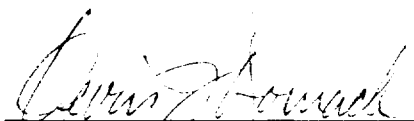

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GLOSSARY

1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane
1,2-DCA	1,2-Dichloroethane
1,2-DCE	1,2-Dichloroethene
AMS	Arts Manufacturing and Supply
site	Beloit Corporation Blackhawk Facility
BCP	Beloit Corporation Plant
BCRC	Beloit Corporation Research Center
BGL	below ground level
BMDL	below method-detection level
BOD	Biological Oxygen Demand
BEHP	Bis(2-ethylhexyl)phthalate
COD	Chemical Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation and Liabilities Act
CLP	Contract Laboratory Program
CRQL	contract required quantitation limit
EM	Electromagnetic
eV	Electron Volts
F	Fahrenheit
FS	Feasibility Study
FSSA	Fiber Sludge Spreading Area
Soterion	Former Soterion/United Recovery Facility
FSDA	Foundry Sand Disposal Area
GC	gas chromatograph
HSP	Health and Safety Plan
IEPA	Illinois Environmental Protection Agency
MAG	Magnetometer
MCLs	Maximum Contaminant Levels
MSL	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
PAH	Polynuclear Aromatic Hydrocarbon

PID	Photoionization Detector
PCB	Polychlorinated Biphenyl
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
ROD	Record of Decision
RI	Remedial Investigation
SVOC	semivolatile organic compound
SER	Site Evaluation Report
SS	soil sample
SP	standpipe
SYA	Storage Yard Area
SARA	Superfund Amendments and Reauthorization Act of 1986
TAL	Target Analyte List
Tech Memo 1	Technical Memorandum 1
TIC	Tentatively Identified Compound
TSP	Trisodium Phosphate
PCE	Tetrachloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TE	Thermo Environmental
TOC	top of casing
TCE	Trichloroethene
TCL	Target Compound List
ug/kg	microgram per kilogram
ug/L	microgram per liter
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

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INTRODUCTION

Technical Memorandum 1 (Tech memo 1) describes the performance and findings of Phase 1 of the Remedial Investigation (RI). Data collected prior to initiation of the RI have been summarized in various technical documents and considered in this technical memorandum. However, the majority of the analysis for site conditions relies on data collected as part of the Phase 1 investigation.

Section 1 provides information regarding the authorization, background, purpose, and objectives of this report. In addition, the scope of work performed for this investigation is outlined and the organization of the report is presented.

1.1 AUTHORIZATION AND BACKGROUND

This Remedial Investigation/Feasibility Study (RI/FS) is being conducted on behalf of Beloit Corporation/Harnischfeger Industries for the site by Warzyn Inc. The project is being performed pursuant to the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) of 1980, as amended by Superfund Amendments and Reauthorization Act (SARA) (U.S. EPA), as required by the Consent Decree (Civil Action No. 91 C 20137) dated May 8, 1991, and per the approved Illinois Environmental Protection Agency (IEPA) scope of work outlined in the site planning documents dated June 1992 (Warzyn, 1992) which includes the Quality Assurance Project Plan (QAPP) and the Health and Safety Plan (HSP). Oversight of the RI/FS is being conducted by Ebasco Environmental, Inc. on behalf of the IEPA.

CERCLA requires that after discovery of a possible release or threatened release of hazardous substances (in conjunction with the U.S. EPA Hazard Rank Scoring System), pollutants or contaminants from a site, a preliminary determination be made as to whether the site presents, or may present, a threat to the public health or the environment. If additional action is determined to be warranted the U.S.

EPA places the site on the National Priorities List (NPL) of hazardous waste sites. Additional investigative work is then undertaken at NPL sites to identify source areas, determine potential problems, develop and evaluate possible remedial alternatives and select a remedial action based on the evaluation. This process for selection of remedial actions consists of the following three elements:

- Remedial Investigation (RI) - During the RI, data is collected to define site conditions, including the identification of potential source areas, extent of releases from the site, and the character of source materials. Data on releases are evaluated to assess the potential effects of releases on public health and the environment.
- Feasibility Study (FS) - In the FS, a number of potential remedial alternatives are developed, evaluated against a range of factors and compared against one another.
- Selection of Remedy - Based upon the results of the FS, the IEPA will indicate a preference for particular remedial measures and prepare a Proposed Plan for the site. This plan, together with the RI and FS reports, is placed in the administrative record for review and comment by the public. The IEPA makes a final selection of the remedy for a particular site after comments are reviewed, considered, and addressed. The selection of a final remedy is documented in the Record of Decision (ROD).

1.2 PURPOSE AND OBJECTIVES

This report was prepared to present the data, results, conclusions, and recommendations of the RI for the site.

The purpose of the RI is to gather data on the characteristics of the following:

- Groundwater
- Soils
- Geology
- Hydrogeology

The objective of the RI is to identify potential source areas and to determine the nature and extent of potential contamination and contaminant migration pathways at the site, and evaluate potential impacts off the site in order to support the activities of the FS. Specific objectives included:

- Assessment of the physical and chemical characteristics of surficial and subsurface soils
- Determination of geologic conditions
- Determination of hydrogeology and assess groundwater hydraulics
- Assessment of groundwater quality
- Assessment of potential contaminant migration pathways
- Characterize public health and environmental risks.

This information is used to assess potential source areas, and the extent and migration pathways for the contaminants found to be present at the site. This information will be incorporated into the final RI report and will be used to support the evaluation of remedial alternatives in the FS.

1.3 SCOPE OF WORK

The Work Plan (Warzyn, 1992) for this project specifies a phased, iterative approach to the investigation. Figure 1 presents the sequence of activities for Phase 1 and the potential activities for Phase 2 of the RI.

1.3.1 Phase 1 Investigation

The field work completed as part of the approved Work Plan to achieve the Phase 1 objectives included the following activities:

- Preparation of a site map
- Pre-RI location and elevation survey of existing features
- Existing monitoring well evaluation
- Existing monitoring well and standpipe abandonment

Source Characterization:

- Electromagnetic (EM) and Magnetometer (MAG) survey
- Soil gas survey
- Drilling and soil sampling 13 shallow soil borings

Migration Pathway Assessment:

- Geotechnical boring

- Drilling and groundwater sampling of five deep and two intermediate groundwater quality borings
- Installation of 17 groundwater monitoring wells (W19, W19B, W20R, W20B, W21, W21B, W22, W22B, W22C, W23, W23B, W24, W25C, W26C, W27, W28, and W29) and the abandonment and replacement of five existing groundwater monitoring wells (W03R, W05R, W08R, W11R, and W16R)
- Installation of three staff gauges
- Monitoring well development
- Location and elevation survey of newly installed monitoring wells and staff gauges
- Groundwater level measurements
- Hydraulic conductivity testing
- Surface water and sediment investigation
- Air quality assessment

Contaminant Characterization:

- Groundwater sampling and analysis (Round 1)
- Surface water and sediment characterization
- Air quality characterization

1.4 REPORT ORGANIZATION

Tech memo 1 consists of three volumes, which may be referenced by their respective contents, as follows:

Volume I	Text with Tables, Figures, and Drawings
Volume II	Appendices A-E
Volume III	Appendices F-I

A brief description of the contents of each section of this report 1 is as follows:

- Section 2 presents a brief site setting and history.

- Section 3 contains regional information.
- Section 4 presents a summary description of field procedures used to collect the data for Phase 1 of the RI.
- Section 5 contains details of the physical characterization of the site, including surface topography, geology, hydrology, and hydrogeology.
- Section 6 contains a description of the nature and extent of contamination at the site.
- Section 7 presents an evaluation of the actual or potential migration of contaminants and the transport and transfer of contaminants within and between media.
- Section 8 provides a summary of findings for the RI.
- Section 9 includes the references utilized and cited throughout the report.

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SITE SETTING AND SITE HISTORY

This section provides information on the site setting, site history, and previous reports which characterize site conditions.

2.1 SITE SETTING

2.1.1 Location

The site is located in Rockton Township, in north-central Illinois (Drawing A1). The site lies in a mixed industrial and residential area approximately 0.5 mile north of the City of Rockton. The site occupies part of the northern half of Section 13 and the southeast quadrant of Section 12, T46N, R1E, Winnebago County, Illinois.

2.1.2 Boundaries

The RI/FS boundary, as identified by the IEPA, includes Beloit Corporation property, the neighboring Blackhawk Acres Subdivision and Soterion (Drawing A1). The site is bounded on the north by Prairie Hill Road, on the west by the Rock River, on the south by a line projected along a Beloit Corporation access road from Blackhawk Boulevard to the Rock River, and on the east by Blackhawk Boulevard.

2.1.3 Physical Features

Drawing F1 shows the physical features that exist within the RI/FS boundary. The Beloit Corporation manufacturing plant (BCP) is located at 1165 Prairie Hill Road in Rockton, Illinois. They are a manufacturer of machines that produce layered paper products from paper pulp. In addition to the manufacturing plant, a research center is located on Beloit Corporation property. The Beloit Corporation Research Center (BCRC) designs and demonstrates paper-making machines. The property upon which the facility is located was farmland prior to purchase by Beloit Corporation in 1957.

There are several structures located on Beloit Corporation property as indicated on Drawing F1. Two wastewater treatment ponds and two clarifier tanks are located west of the BCRC. The BCRC (40,000 sq ft) is located in the north-northwest portion of the property. The BCP (230,000 sq ft) is located south-southwest of the BCRC.

Large outdoor storage yard areas (SYA), which hold scrap metal, pipe and miscellaneous equipment are located on the northeast and southwest sides of the BCP (Drawing F1). These storage areas are partially paved with asphalt. The remainder of the storage yard areas are covered with crushed stone. Also, asphalt parking lots exist between the BCP and the BCRC, and between the BCP and the railway.

A former foundry sand disposal area (FSDA) is located southwest of the BCP and a former fibrous sludge spreading area (FSSA) is located south of the BCP (Drawing F1). An inactive gravel pit, currently owned by Beloit Corporation, is located east-northeast of the BCRC. The gravel pit is separated from the main Beloit Corporation property by a company driveway and railway.

Additional structures identified within the site boundary are the homes and roadways that make-up the Blackhawk Acres Subdivision, and buildings and paved areas at Safe-T-Way and Soterion.

2.2 SITE HISTORY

2.2.1 History of Previous Investigations, Response Actions, and Reports

This section lists in chronological order, the investigations, response actions, and reports prepared for the site. A synopsis of investigation methods and results is provided. Historical data is considered non-CLP and not intended for interpretation. For more detail, refer to the original reports.

Between 1980 and 1982, the IEPA investigated United Recovery, which was operating at the Soterion property, on several occasions and conducted a groundwater quality study of private water supply wells located in the Blackhawk Acres Subdivision. Subsequent investigations led to a groundwater quality study of the area in the vicinity of the Soterion and Beloit Corporation properties.

United Recovery was an industrial waste processing plant located at Soterion (800, 824, and 900 Watts Avenue) (Drawing F1). This facility reclaimed high speed drill cuttings and cooling oil. Complaints of poor waste handling practices and detections of elevated levels of VOCs in many of the homes located on Watts Avenue near Soterion prompted the IEPA to investigate the property from 1980

through 1982. During their inspections of the property, the IEPA documented releases of waste oils on the property grounds, in a septic system, and in a dry well located in front of 900 Watts Avenue. Water quality samples collected by the IEPA in 1981 and 1982 from Soterion indicated the presence of elevated metals concentrations, and Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) in the septic system. Samples of groundwater collected from an inactive water supply well at this site did not indicate elevated concentrations of metals or Volatile Organic Compounds (VOCs). The well was not purged prior to sampling.

During October 1981, the Beloit Corporation applied sludge from their former wastewater treatment lagoons to approximately 10 acres of land at the southeast end of the Beloit Corporation property (Drawing F1). In 1983, the Beloit Corporation obtained a permit for this operation. A chemical analysis of the sludge indicated concentrations of chloroform ranging from 50 to 354 ug/kg and trans-1,2-dichloroethene ranging from 35 to 363 ug/kg.

In May 1983, Beloit Corporation collected a sample of wastewater from the BCRC before the water entered the former wastewater treatment lagoons. The analysis indicated a concentration of 6.3 ug/L (tetrachloroethene) PCE. Beloit Corporation stopped using chlorinated solvents in the summer of 1983 and switched to di-n-octyl phthalate.

On March 2, 1983, and on August 9, 1983 the IEPA collected two wastewater samples and one waste water sample, respectively from each of Beloit Corporation's, now abandoned, wastewater treatment lagoons (Drawing F1). VOCs were detected in these samples. Beloit Corporation collected wastewater samples from these former wastewater treatment lagoons in 1984 and again on September 11, 1987. In these instances, VOCs were not detected. Beloit Corporation and IEPA VOC analytical reports are presented in Appendix B of the Site Evaluation Report (SER) (Warzyn, 1990). Beloit Corporation's 1984 wastewater lagoon VOC analytical results can be found in a report, FIBROUS SLUDGE LANDSPREADING EVALUATION, BELOIT CORPORATION, prepared by Warzyn Inc. in 1985.

Groundwater monitoring wells W1, W2 and W3 (replaced in Phase 1 with W3R) were installed in October 1983, on Beloit Corporation property to comply with an IEPA permit requirement (see Drawing F1 for well locations).

Since 1983, groundwater samples have been periodically collected for VOC analysis from these three monitoring wells (W1, W2, and W3) located on Beloit Corporation property. The VOCs detected included 1,1,1-TCA (5 to 512 ug/L), TCE (6 to 142 ug/L), 1,1-DCE (Below Method Detection Limit (BMDL)), 1,1-

DCA (1.6 to 678 ug/L), and PCE (1.95 to 18 ug/L). Results are from Northland Environmental, CompuChem, and Warzyn Laboratories (as summarized in Table 5, Warzyn 1990). In addition, 17 private water supply wells were sampled for VOCs on January 24, 1984.

Beloit Corporation contracted with Warzyn in early 1984 to assess the groundwater quality at the site in Rockton, Illinois. Warzyn performed a hydrogeologic investigation (Warzyn, 1984) to assess the groundwater quality at the site due to inconclusive results from the initial sampling done on the first monitoring wells installed on the Beloit Corporation property. The investigation included the following work:

1. Eight soil borings were drilled and instrumented as groundwater monitoring wells.
2. Water level measurements were obtained from all monitoring wells, ponds located on Beloit Corporation property, and the Rock River.
3. A well elevation survey was conducted.
4. Groundwater samples were collected and analyzed.
5. Two surface soil samples were collected and analyzed.

The conclusions drawn from the chemical analysis were that chloride and conductivity were elevated probably because of road salting, and manganese was elevated due to natural conditions in the area. VOC analytical results were below detection limits, except for samples from wells W1, W3, and W5. The report discussed several different potential sources of VOC contamination detected in the monitoring wells and private wells. Of the potential sources, the Beloit Corporation SYA and FSDA, and Soterion were identified as having the highest potential as VOC sources.

On October 2, 1985, an anonymous complaint regarding barrels dumped at the site prompted an investigation by the IEPA. Five 55 gallon drums were discovered near the location of well W6. The drums, which appeared to have contained paint or primer, were tipped over and the liquid contents of three of the drums were left in a small puddle. Near the other two drums, 2 to 4 in. of a solid material with a paint-like odor was observed. Two samples were collected for VOC analysis and an EP toxicity test for metals. The results of the toxicity tests indicated low levels of barium and cadmium. The VOC analytical results indicated detectable concentrations of several VOCs.

Beginning in May 1986, the IEPA began a study of the VOC contamination problem in the general area of Soterion and Beloit Corporation properties (IEPA, 1988). The report identified the geology and hydrogeology of the area and summarized results from groundwater quality samples. Sixteen of the 55 private wells that were sampled contained VOCs. Three of those exceeded U.S. EPA Maximum Contaminant Levels (MCLs) (910, 918, and 1314 Watts Avenue). Monitoring wells G104 and G109 also had detectable levels of VOCs. The report stated that the VOCs in these wells indicated that groundwater contamination was migrating from Beloit Corporation property. The report also concluded that an additional investigation is necessary to determine the location(s) of the contamination on Beloit Corporation property. VOCs were detected at the southwestern boundary of Beloit Corporation property near the two private wells of Dr. & Mrs. Trull. However, no VOCs were detected in the two private wells located on Trull property. Monitoring wells G108S and G108D were installed southeast of the Blackhawk Acres Subdivision to determine if contamination was traveling toward Rockton municipal well no. 5 and a new housing development. A round of samples from these wells contained no VOCs.

In 1986, Warzyn provided several conclusions and recommendations in a groundwater information review report (Warzyn, 1986) for further investigation resulting from an evaluation of existing information pertaining to VOCs detected near the Beloit Corporation property. The recommendations included:

1. Perform a soil gas survey in the vicinity of wells W3 and W5 to evaluate the horizontal extent of VOCs in that vicinity.
2. Based on results of the soil gas survey, install additional wells in the vicinity of well W3.
3. Continue monitoring of well W1 to evaluate the presence of VOCs at this location.
4. Conduct a soil gas survey along the eastern boundary of the site to assess the potential for the presence of VOCs between wells W2, W4 and W10.

The Beloit Corporation retained Warzyn to perform an investigation that would evaluate the Beloit Corporation property and Soterion as potential VOC sources (Warzyn, 1987). The investigation was performed in two phases. Phase 1 consisted of the collection and analysis of one ambient air sample, two soil gas samples at Soterion and six soil samples at the FSSA. The report summarized that low concentrations of VOCs in the soil and ambient air at Soterion prevented Warzyn from drawing conclusions regarding VOC sources. Only two less than detectable readings were indicated at the sludge spreading area.

Phase 2 included the installation of twelve standpipes and six monitoring wells. Soil samples were collected from five borings. In-field hydraulic conductivity tests that were performed on the wells indicated a range of 1.3×10^{-4} cm/sec to 2.7×10^{-2} cm/sec. Horizontal flow velocities were computed at 3 ft/yr to 157 ft/yr and the horizontal gradient was 1.4×10^{-3} ft/ft to 3.3×10^{-3} ft/ft. The only measurable vertical gradient (well nest W8/W11) was 0.02 ft/ft upward. VOCs were detected in nine of the wells which were sampled. The most commonly detected VOCs were 1,1,1-trichloroethane (1,1,1-TCA) and PCE. The areal distribution of VOCs in the monitoring wells was irregular and did not suggest that a single VOC plume existed. A discussion of potential sources of VOCs identified possible locations as the Beloit Corporation property, Soterion, and various areas along Watts Avenue.

During July 1987, the three-celled wastewater treatment impoundment operated by Beloit Corporation was taken off-line. A new wastewater treatment system was constructed in October 1988. During the interim, wastewater was hauled to an off-site contractor for treatment. In 1983, Beloit Corporation sampled the wastewater effluent and collected wastewater samples from the three settling ponds. VOCs were detected in each sample and ranged between 1.4 and 6.3 ppb (total VOCs). The IEPA also sampled the wastewater effluent and collected wastewater samples from two of the three settling ponds in 1983. Total VOCs, ranging in concentration between 1 and 30 ppb, were detected in the settling pond samples, however, no VOCs were detected in the wastewater effluent sample. On September 11, 1987, wastewater samples were collected from two of the settling ponds by Beloit Corporation. No VOCs were detected in this treated effluent.

On June 24, 1988, the U.S. EPA proposed to list the site on the Superfund NPL (NPL Update No. 7).

Beloit Corporation contracted with Warzyn to perform a Phase 3 investigation (Warzyn, 1989) in 1989. The report summarized the findings of the Phase 3 investigation by Warzyn, which included placement of shallow soil borings, physical geotechnical testing and chemical laboratory analysis of selected soil samples, monitoring well installation, groundwater elevation measurement, and groundwater quality monitoring. The results of this study showed that VOCs appeared to be located in two areas. The first is localized around monitoring well W1 at low concentrations. The second area is at the southern end of Beloit Corporation property near monitoring wells W5, and stand pipes SP4 and SP5 (Drawing F1). Groundwater quality results also suggested that the VOC plume in the southern part of the Beloit Corporation property may be moving downward in response to recharge along the flow path. The report summarized that a VOC source may be located near standpipe SP4 and boring B4. Due to the groundwater flow conditions in the area and the difference in specific VOCs detected in both

the Beloit Corporation wells and the private water supply wells, it was concluded that there may be multiple contaminant sources.

On August 30, 1990, the Beloit Beloit Corporation Blackhawk Facility was officially entered on the NPL.

[mad-606-198a]

REGIONAL INFORMATION

This section provides regional background information for the area surrounding the site regarding:

- Topography, drainage, and soils
- Bedrock and glacial geology
- Hydrogeology
- Groundwater use
- Climate

3.1 TOPOGRAPHY, DRAINAGE, AND SOILS

The site is located approximately one-quarter of a mile north of the City of Rockton, Illinois, on the broad (approximately 8 mile wide), relatively flat, Rock River/Pecatonica River alluvial valley (Drawing A2). Surface elevations range from approximately 900 ft MSL, on the broad gently rolling uplands, to slightly less than 720 ft MSL where the floor of the Rock River/Pecatonica River alluvial valley meets the southerly flowing Rock River and the easterly flowing Pecatonica River. Upland topography is primarily controlled by erosion and bedrock topography and the Rock River/Pecatonica River alluvial valley topography is primarily controlled by post glacial fluvial erosional and depositional processes.

The rolling topography on the uplands reflects the dendritic network of erosional drainageways that direct runoff toward the Rock and Pecatonica Rivers, which are responsible for draining this area; they are the only substantial surface water features in the vicinity. Surface soils in this area consist of Comfrey-Selma soils which are deep, poorly drained, nearly level soils that have formed on flood plains and/or low stream terraces in recent alluvial and/or glacial outwash sediments

where they are present (Soil Survey of Winnebago and Boone Counties, Illinois, 1980).

3.2 GEOLOGY

3.2.1 Regional Glacial Geology

Upland areas tend to be blanketed with a thin (less than 100 ft) veneer of glacial drift and the drift-filled alluvial valleys are blanketed with a thin veneer of alluvium where present. Drawing A5 is a surficial geology map that shows the distribution and type of surficial material that blankets Winnebago County. The site appears to be dominated by Cahokia alluvium and Henry Formation, Mackinaw member sands and gravels.

Bedrock valleys tend to be filled with several hundred feet of interbedded glacial sands, gravels, silts, and clays. Distribution of this valley train material was primarily controlled by the orientation of the bedrock valleys with respect to the direction of ice movement and the various ice front positions. The Rock Bedrock Valley, in which the normal direction of drainage (south) was away from the Green Bay Ice Lobe, functioned as a major drainageway that probably carried enormous quantities of glacial meltwater away from the ice front, resulting in valley fill dominated by coarse-textured, permeable sands and gravels. The Pecatonica/Sugar Bedrock Valley, in which the normal direction of drainage (east) was toward the Green Bay Ice Lobe, was probably blocked by rapidly accumulating sediments that were deposited by the aforementioned glacial melt waters or an advancing ice lobe, resulting in the formation of a glacial lake. Valley fill that was deposited as a result of this unique environmental setting is dominated by finely-textured, low permeability lacustrine silts, sands, and clays. Drift thickness in the Rock Bedrock Valley ranges between 200 and 250 ft in the north and is 250 ft in the south. In the Pecatonica/Sugar Bedrock Valley, drift thickness is approximately 150 ft upvalley and 250 ft at the junction of the Pecatonica/Sugar and Rock Bedrock Valleys (Drawing A6).

3.2.2 Regional Bedrock Geology

The succession of bedrock units that subcrop beneath Winnebago County generally dip to the southeast. Drawing A3 is a bedrock geology map that shows the distribution and type of bedrock units that underlay the glacial drift in Winnebago County. They are, in order of increasing age (increasing depth):

- **Galena Group** - It is the uppermost bedrock unit in Winnebago County and, is the dominant surficial bedrock unit over most of southern and eastern Winnebago County. It is a medium- to coarse-grained, partly

cherty brown dolomite and reaches a maximum thickness of 250 ft in southern Winnebago County.

- Platteville Group - This gray to brown dolomite is generally finer grained and thinner bedded (100 ft in thickness) than the overlying Galena Group. It is the dominant surficial bedrock unit in northern Winnebago County and along the walls of the Rock, Pecatonica, and Sugar Bedrock Valleys.
- Ancell Group - It is comprised of the Glenwood Formation and the St. Peter Sandstone. The Glenwood formation consists of interbedded dolomite, sandstone, and shale that, collectively, range from 5 to 60 ft in thickness where they have not been removed by erosion. Sand content increases with depth resulting in a basal unit that grades into the underlying St. Peter Sandstone. The St. Peter Sandstone is a fine- to coarse-grained sandstone that is characterized by a high percentage of well-rounded quartz grains. There is usually a cherty basal member interbedded with conglomerate, siltstone, clay, or shale. The average thickness of this unit is 270 ft.

The dissected bedrock topography (Drawing A4) in Winnebago County resulted primarily from fluvial erosional processes and, to a lesser degree, from erosional processes associated with Pleistocene glaciation. This surface is dominated by the Rock Bedrock Valley and its two main tributaries, the Pecatonica and Sugar Bedrock Valleys.

Elevations in the deepest parts of the Rock Bedrock Valley range from approximately 500 ft Mean Sea Level (MSL) (a depth of 200 ft) in the north to 450 ft MSL (a depth of 250 ft) in the south. Bedrock elevations in the Pecatonica/Sugar Bedrock Valley range from slightly less than 600 ft MSL (a depth of 150 ft) in upstream positions to slightly less than 500 ft MSL (a depth of 250 ft) where the Pecatonica/Sugar Bedrock Valley joins the Rock Bedrock Valley. A significant portion of this eroded bedrock surface is buried beneath glacial drift.

3.2.3 Hydrogeology

The eventual destination of all precipitation that falls on Winnebago County is the Rock River, which ultimately empties into the Mississippi River. Only about 10% of this precipitation will actually enter the local groundwater system (Berg, Kempton, and Stecyk, 1984). The uplands probably provide the greatest amount of recharge to both shallow and deep aquifers in Winnebago County. Groundwater generally flows from the uplands (recharge) down into the lowlands (discharge/recharge) and into the local river system (discharge). Although

lowland areas (alluvial plains) are typically regarded as discharge zones, they are known to provide for some local recharge to shallow aquifers. Virtually all water that infiltrates into the groundwater system in lowland terrains adjacent to the Rock, Pecatonica, or Sugar Rivers and which is not extracted by water supply wells will most likely move directly toward the river and into the surface water system.

Bedrock aquifers and glacial drift aquifers in Winnebago County provide significant quantities of water for industrial and municipal use. Primary bedrock aquifers that subcrop beneath glacial drift are the St. Peter Sandstone and the Galena/Platteville dolomite. The Rock Bedrock Valley glacial drift deposits are dominated by high capacity, thick sand and gravel aquifers, whereas, the Pecatonica/Sugar Bedrock Valley glacial deposits are dominated by low capacity sand and silt bearing aquifers (Hackett, 1960).

3.3 GROUNDWATER USE

Private water supply wells in the immediate vicinity of the site draw water from the unconsolidated sand and gravel aquifer at depths ranging from approximately 60-70 ft (personal communication from a Bloyer Well Company representative). Beloit Corporation's high capacity water supply wells and the City of Rockton municipal water supply wells are discussed in Section 5.2.5. Available private water supply well logs are contained in Appendix A.

3.4 CLIMATE

3.4.1 Climate

The Rockton area is characterized by the typical continental climate of interior North America. During the winter months (November through February), the average temperature is approximately 27.2°F and prevailing winds are out of the west-northwest at a mean speed of approximately 10.5 miles per hour (mph). During the summer months (June through September) the average temperature is approximately 70°F and prevailing winds are out of the south-southwest at a mean speed of approximately 8.5 mph. Extreme highs (100°F) and lows (-23°F) have been recorded at the Beloit, Wisconsin, National Oceanic and Atmospheric Administration (NOAA) observing station (1951-1980). Mean annual precipitation is 32 inches with maximal rainfall occurring during the months of June through September. The closest NOAA meteorological recording station is in Rockford, Illinois, and the closest meteorological observing station is in Beloit, Wisconsin. Normal mean precipitation, temperature, and humidity for the

Rockford, Illinois NOAA recording station over the period 1951 - 1980 are presented in Table 8 of the SER.

[mad-606-198b]

SUMMARY OF WORK PERFORMED

The work performed for the RI was conducted in accordance with the Statement of Work (Attachment 1 of the Consent Decree) and the work plan documents. This section describes the field tasks, performed during the RI, as listed:

- Evaluation of Existing Monitoring Wells
- Abandonment of Existing Standpipes and Monitoring Wells
- Soil Gas Survey
- Shallow Soil Borings
- Surface Soils
- Borehole Geophysics
- Surface Geophysics
- Private Well Sampling
- Monitoring Well Installation and Replacement
- Monitoring Well Development
- Groundwater Sampling While Drilling
- Location and Elevation Survey
- Water Level Measurements
- Hydraulic Conductivity Testing
- Round 1 Groundwater Sampling
- Surface Water and Sediment Investigation.
- Air Quality Monitoring
- Equipment Decontamination Procedures

4.1 EXISTING MONITORING WELL EVALUATION

An inventory and evaluation of existing monitoring wells was performed to assess their condition. This included IEPA and Beloit Corporation wells (see Table 4-2). Well conditions were assessed by use of the following criteria:

- Well location
- Integrity of the protective casing (including cap, lock, and identification) and the surface seal
- Integrity of the well casing and screen as determined by running a 6-ft PVC bailer down the well to check for obstructions and foreign matter in the well (an indicator of possible screen damage)
- Water level
- Total well depth
- Amount of sediment in the well

From this information a determination was made to abandon and replace monitoring well W16. Abandonment procedures are explained in Section 4.2 and abandonment documentation is provided in Appendix B.

The condition of existing staff gauges was evaluated to determine the need for repair or replacement. Staff gauge SW3 was found and required relocation. Other existing staff gauges were not found, therefore, were replaced at the locations shown on Drawing F1.

Existing monitoring wells W1, W2, W4, W6, W7, W9, W10, W12, W13, W14, W15, W16, W17, W18, G101, G103S and D, G104, G107, G108S and D, G109, and G110 were evaluated as described in Section 4.1 of this report. Monitoring wells W3, W5, W8, and W11 were not evaluated, because they were to be replaced during this investigation. Monitoring wells W1, W2, W6, W7, W9, W10, and G101 were not sampled, because they are not constructed of stainless steel. Wells W27, W28, and W29 were installed in addition to the original scope of work as water table wells which were to be used for obtaining water levels only. IEPA monitoring well G102 was not evaluated, because it could not be located. After an extensive search, it was concluded that this well had inadvertently been destroyed. All of the wells that were evaluated were found to be locked (with the exception of IEPA well G101) and in reasonably good condition. The following were noted:

- Prairie grass roots were found in wells G101, W2, and W12. Much of this root material was removed during re-development of these wells.

- Monitoring wells W4 and W16 were found to be dry (screen is above the current water table), and well W12 was found to have only 6 to 8 in. of standing water.

Monitoring well W16 was abandoned and replaced during this phase of the RI. It is recommended that well W4 be abandoned and then replaced with a water table well to be located adjacent to well W26C. It is also recommended that well W12 be abandoned and replaced with a water table well.

4.2 ABANDONMENT OF EXISTING STANDPIPES AND MONITORING WELLS

Standpipes at the site were abandoned because there were no protective covers, and their integrity was questionable (i.e., they could not be sampled or used for water levels). Several monitoring wells were abandoned and replaced, because they either had polyvinyl chloride (PVC) screens or were dry, and not usable for investigation purposes. Abandonment was performed in accordance with IEPA's guidance document - Groundwater Monitoring Network for Non-Hazardous Solid Waste Disposal Facility (1990). A description of which standpipes and wells were abandoned is provided in the following paragraphs.

Existing standpipes 1, 3, 6, 8, 9, 10, 11, and 12 (Drawing F1) were abandoned on July 14, 1992. Standpipes 2, 4, 5, and 7 could not be located. It is assumed they were destroyed. Each standpipe was abandoned by use of a tremie pipe to pump neat cement grout into the standpipe from the bottom of the standpipe until full. On July 15, 1992, each standpipe was filled with 3/8 in. bentonite chips to approximately 1 ft below ground level (BGL). The PVC was then cut off to approximately 1 ft BGL then covered with topsoil and sod.

Monitoring wells W3 and W5 (Drawing F1) were abandoned on July 24, 1992. Both wells were pumped full of neat cement grout from the bottom to ground surface by use of a tremie pipe. On July 25, 1992, wells W3 and W5 were topped off with granular bentonite to ground surface after the well casing had been cut off approximately 1 ft BGL.

Monitoring wells W8 and W11 (Drawing F1) were abandoned on August 4, 1992. Both wells had the well casing completely removed by pulling with the drill rig winch. Both wells were then pumped full of neat cement grout from the bottom to ground surface by use of a tremie pipe. The grout did not settle, so the wells did not need to be topped off with bentonite.

Monitoring well W16 (Drawing F1) was abandoned on August 19, 1992. The well was completely dry, therefore, the well casing was completely removed by pulling with the drill rig winch. The well hole was filled with granular bentonite to ground surface.

Monitoring well W20 (Drawing F1) was abandoned on July 21, 1992. The well had not yet been completed so the well casing was removed and the remaining hole was filled with 3/8-in. bentonite chips to ground surface.

A complete record of all abandonment documentation is contained in Appendix B. Appendix C contains well construction documentation of replacement wells for the abandoned wells mentioned above.

4.3 SOIL GAS SURVEY

A soil gas survey was performed across the site, and in suspected contaminant source areas between July 13 and 29, 1992. The objective of this survey was to locate potential sources of VOCs. Drawing F2 illustrates the soil gas sampling locations.

A team of two individuals performed the survey using an Arts Manufacturing and Supply (AMS) Retract-a-Tip soil gas kit, and a Thermo Environmental (TE) Model 580B Photoionization Detector (PID). Sample locations were measured from the nearest permanent landmark and recorded in the field logbook. Each sample was collected using the following procedures:

- Drive a 1/2-in. dia solid rod to a depth of approximately 2.5 to 4 ft below ground surface to create a pilot hole.
- The rod was replaced with an AMS Retract-a-Tip gas vapor probe. This probe was driven down the pilot hole using a slam bar.
- The screen casing was pulled back to expose the screen.
- The Teflon vapor tube, which is exposed at the surface, was slipped over the sample tip of the TE 580B PID.
- The sample vessel (Tedlar bag) was connected to the exhaust (sample) port of the TE 580B PID with Teflon tubing.
- Both ports on the Tedlar bag were opened.

- The pump (TE 580B PID) was switched on and allowed to draw in-situ soil gas through the system for a minimum of 2 min.
- After 2 min. the sample port on the Tedlar bag was closed and the bag allowed to fill.
- With the pump still running, the input port of the Tedlar bag was closed, then the pump was switched off.
- The Tedlar bag was disconnected from the pump, shielded from sunlight, and placed on ice in a cooler. The samples were transported to the site trailer and analyzed using an in-field gas chromatograph (GC).
- The pump (TE 580B PID) was disconnected from the AMS soil gas probe teflon vapor tube.
- The probe was extracted from the pilot hole using the AMS jack.
- Prior to collecting the next sample, the external surface of the AMS gas vapor probe and the pilot rod were decontaminated by washing in a trisodium phosphate (TSP) solution than rinsed in DI water and allowed to dry. Then the probe, pump and Teflon tubing were connected and purged with atmospheric air by running the pump for a minimum of 1 min. Tedlar bags that were used were re-used if GC results show no detectable VOCs, and the Tedlar bag has been decontaminated with high purity helium gas.

For each day of sampling, the barometric pressure and temperature were recorded in the morning prior to the start of sampling, during the day around noon, and at the end of each day, and a background ambient reading was taken.

A total of 93 samples, nine field duplicates, and eight field blanks were collected and analyzed by field GC. Sixteen additional sample locations were surveyed by field PID only. These 16 locations are noted as the 200 series in the log book and on Drawing F2. Each sample had a field PID reading less than background. Samples other than 200 series samples were analyzed by GC, as a confirmation of the field PID readings.

A list of field PID soil gas detects that were above background readings can be found in Table 4-1. The samples that had positive PID readings, but did not show any detects of the target compounds by GC analysis, may have been affected by soil moisture and humidity. Sample SG30 is an example of this, as was noted in the field logbook.

Additional samples were collected in the areas of SG57, SG107, and SG130 to further define possible contamination in these areas. For each case, higher PID readings than was found at SG57, SG107 or SG30 were not found at short distances from the listed location.

4.4 SHALLOW SOIL BORINGS

Thirteen shallow soil borings (SB8 through SB21; Drawing F1) were drilled to identify the presence of VOCs in potential source areas. The borings were drilled to a minimum depth of the water table (25 to 35 ft) by using 4 1/4 in. I.D. hollow stem augers. Soil boring SB20 was abandoned after encountering a metal obstruction at a depth of 4.5 ft. Soil boring SB21 was drilled as a replacement for SB20.

Soil samples were collected at 2.0-ft intervals using a 3-in. diameter split spoon sampler. The 3-in. diameter sampler was needed to acquire enough sample volume for laboratory analysis. Soil boring logs describing the materials encountered, Unified Soil Classifications (USCS), visual evidence of contamination, and PID screening results were recorded by the field geologist and are included on soil borehole logs contained in Appendix D.

A sufficient quantity of representative soils was collected from each split spoon sample to fill, at a minimum, one 8-oz wide mouth glass jar for semi-volatile analysis, one 8-oz wide mouth glass jar for pesticide/PCB analysis, one 8-oz wide mouth glass jar for metals and cyanide analysis, and two 4-oz wide mouth glass jars for VOCs analysis. Some samples could not be collected for full Target Compound List (TCL) analysis due to insufficient volumes recovered or due to soils encountered (i.e., gravels). Vertical split samples were collected from the split spoon samples by cutting the soil sample in half (parallel with the long axis of the split spoon sampler) and collecting samples, top to bottom, from each half of the split spoon device. One half of the split spoon sample was used to fill the 4-oz sample jars immediately after opening the split spoon. The other half was used to log the borehole and fill the four 8-oz soil sample jars, one of which was used for field headspace analysis.

One partially filled 8-oz wide mouth jar was collected from each split spoon for field head space analysis. The results of the head space analyses were used to determine which samples would be sent for laboratory analysis. An 8-oz glass sample jar was filled with representative soil collected from the split spoon sample. A piece of aluminum foil, sufficient in size to cover the opening and threads of the sample jar, was then placed over the jar opening. The Teflon lid of the jar was then secured snugly over the aluminum foil. The contents of the jars

were heated for approximately 30 min or until the sample reached a temperature of approximately 75° F. Then the lid was removed while keeping the aluminum foil cover in place and an 11.7 eV PID probe was forced through the aluminum foil seal to collect a headspace sample from the jar. A decision to analyze samples from each location was made after all samples at that location had been collected, screened, and visually described.

Twenty-three sets of subsurface soil samples were selected for U.S. EPA CLP analysis based on the following primary criteria:

- Detectable PID (11.7 eV) readings greater than background
- Visual evidence of soil contamination
- Distinct soil stratigraphic changes (e.g., contact at aquifer/aquitard boundary)

Selection of subsurface soil samples for analysis was determined in the field and based on in-field screening results. During sample collection, subsurface soils were visually examined and screened for VOCs with a PID. Subsurface soil samples with obvious visual contamination and/or detectable PID field headspace readings were selected for U.S. EPA CLP analysis.

If no indications of VOC contamination were observed using primary in-field screening techniques, then at least one set of subsurface soil samples was collected using the following secondary criteria:

1. At a distinct soil stratigraphic change if no soil gas readings
2. At a depth of 10 ft for borings in areas with low soil gas readings
3. At a depth of 5 ft for borings in areas with high soil gas readings

Borehole cuttings generated during drilling with PID readings in excess of 5 ppm were placed in 55 gal drums, labeled, and retained on Beloit Corporation property. Cuttings with PID readings below 5 ppm were disposed of on Beloit Corporation property.

The shallow soil borings were abandoned in accordance with IEPA Guidelines. See Appendix B for borehole abandonment documentation.

4.5 SURFACE SOILS

Thirteen surface soil samples were collected at soil boring locations SB8, SB10 through SB13, SB16 through SB19 and SB21, with duplicates taken at samples 11 and 21. An additional surface soil sample was collected at soil gas location SG130, and background samples were collected north of the RI boundary at G107, and another location designated as SB30 as shown on Drawing F1. These surface soil samples were collected primarily to support the risk assessment.

Surface soils were collected by first removing vegetative matter from the area to be sampled. A 2 in. hand auger was used to dig the sample from the upper 6 in. to 8 in. of soil. Soils were placed in a stainless steel bowl, then were immediately packed into sample jars and prepared to be shipped for laboratory analysis.

Decontamination of the sampling equipment was performed before each sampling location by washing in an Alconox solution and triple rinsing with potable water.

4.6 GEOTECHNICAL BORING AND BOREHOLE GEOPHYSICS

A geotechnical boring (GB1) (Drawing F1) was advanced to a depth of 100 ft and used to collect and document samples of representative site soils and to calibrate the natural gamma ray logging tool (Mount Sopris Model 1000-C). The boring was drilled using mud rotary techniques and sampled with a 2-in. split spoon through an open-ended tri-cone bit. The drilling mud was maintained at an approximate weight of 9 lbs/gal. The boring was sampled at 5-ft intervals from 0 to 30 ft, 2.5-ft intervals from 30 to 80 ft and 5-ft intervals from 80 to 100 ft. The objective was to obtain detailed information in lithologic zones of prime interest. A soil boring log is included in Appendix D. The boring was flushed with potable water prior to conducting the borehole geophysical survey. GB1 was abandoned according to IEPA Guidelines following gamma logging.

The natural gamma ray logging tool was used on new monitoring wells, select existing monitoring wells and groundwater quality borings. This tool was used in order to differentiate and identify soil stratigraphic units and variations in clay content in the soil matrix. Natural gamma ray responses were used in conjunction with visual soil descriptions and soil grain size analyses to create final borehole logs for borings drilled during this RI. The natural gamma ray detecting probe was lowered to the bottom of the borehole and then advanced to the surface at a logging rate of slightly less than 1 ft/min. in each borehole, and well logged. Total depths were recorded by direct measurement and by the measuring device incorporated into the logging tool. See Appendix E for natural gamma logs.

4.7 SURFACE GEOPHYSICS

On July 21 and 22, 1992, a series of surface geophysical surveys were conducted at 1314 and 800 Watts Avenue (Drawing F1) by Fromm Applied Technologies of Mequon, Wisconsin. The objective of the EM and MAG surveys done as part of the RI was to evaluate properties adjacent to Beloit Corporation for buried metallic objects, such as underground storage tanks and drums.

At each site, a rectangular coordinate system was established with a 10-ft grid, where possible. The EM measurements were obtained with the instrument at waist height or at ground level when there was an indication of buried metal.

Magnetic measurements were not taken at 800 Watts Avenue due to the sheet metal that was used to construct the quonset huts. Magnetic measurements consisted of total field measurements taken from 2 and 5 ft above ground level. Temporarily, variations in the measured magnetic field due to natural conditions were removed by use of a magnetic base station set up at each site. Measurements recorded by this base station were later used to yield a residual total magnetic field. A complete report of the surface geophysics is included in Appendix F.

4.8 PRIVATE WELL SAMPLING

Fifty three private water supply wells were sampled in Blackhawk Acres Subdivision on July 7, 8, 9, 14, and 22, 1992 (Table 4-3). Two additional water supply wells on the Ezra and Louise Trull property were sampled on July 14, 1992 (Drawing F1). Table 4-3 cross references sample identification numbers with addresses.

An initial inspection of the aboveground water supply system at each private well location was performed to determine if any filters or water softening systems were in place. This inspection helped to determine where in the water supply system the sample event should be collected so none of these systems would bias the sample. Once this was done, the water was turned on at the sampling port (faucet) to begin purging. Volumes purged varied due to information obtained from residents concerning water usage and system capacities (i.e., tank volumes). A record was kept of approximate flow rates and the duration of purging. Temperature, specific conductivity and pH were recorded several times throughout the purge cycle. Following the purging, samples were collected, labeled, and placed on ice in a cooler for later shipment to the laboratory for analysis. IEPA or their oversight contractor (Ebasco) collected split samples from several private wells.

4.9 MONITORING WELL INSTALLATION AND REPLACEMENT

Seventeen new wells were installed (15 on Beloit Corporation property), including nine water table wells and eight piezometers (see Table 4-2 and Drawing F1). One well (W24) was installed hydraulically upgradient of the site along the northern RI boundary to assess background groundwater quality. Existing monitoring wells W3, W5, W8, W11, and W16 were abandoned and replaced. Monitoring wells were installed using 4 1/4-in. I.D. hollow stem augers or reverse air circulation dual tube drilling. Water table wells were constructed with 10-ft long, No. 10 slot (0.010-in.) continuous wrap 2-in. I.D. stainless steel screens placed so the screen intercepted the water table. Piezometers were constructed with 5-ft long No. 10 slot (0.010-in.) continuous wrap 2-in. I.D. stainless steel screens and a 10-ft section of stainless steel riser. The riser above the 10-ft stainless steel riser section consisted of 2-in. I.D. schedule 40 PVC.

The annular space between the well and the edge of the borehole was backfilled with clean silica sand to approximately 2 ft above the top of the well screen. For both water table wells and piezometers, 2 ft of fine silica sand was placed above the sand filter pack. A minimum 3-ft hydrated bentonite pellet or 3/8-in. bentonite chip seal was placed directly above the fine silica sand. At water table wells, the annulus above the pellet/chip seal was backfilled with granular bentonite. At piezometers either bentonite slurry using a tremie pipe, bentonite pellets or 3/8-in. chips, or both was placed above the 3-ft bentonite seal. A granular bentonite surface seal was installed at each well. A locking steel protective casing was installed at the surface of each well. Well construction documentation is contained in Appendix C.

Split spoon soil samples were collected every 2.5-ft during drilling through hollow stem augers. Reverse air drilling did not allow for split spoon sampling, however, bucket samples were collected during reverse air drilling by placing a 5 gal bucket under the cyclone portion of the drill rig (where drill cuttings exit the drilling system), collecting the material exiting and allowing it to settle prior to placing in sample jars. Soil samples representative of local stratigraphy were saved in glass sample jars, so select samples could be submitted for grain size analysis by ASTM D422. Grain size distribution results were used to confirm and enhance the visual description of soils made by the site geologist during drilling. Documentation of the grain size reports are contained in Appendix G and boring logs are contained in Appendix D.

In addition to obtaining a stratigraphic log from split spoon sampling, each of the monitoring well boreholes were natural gamma ray logged. The natural gamma ray logs of the boreholes provided a continuous record of variations in the natural radioactivity of the borehole soils and thus an indication of soil stratigraphy. This

information was used in conjunction with visual soil descriptions and grain size analyses during evaluation of site geology, by indicating variations in clay content in the unconsolidated deposits at the site.

Drill cuttings, drill fluids (mud and water) and extraneous soils derived from split spoon sampling were evaluated in the open atmosphere during drilling with an 11.7 eV PID in the field. If PID readings were equal to or exceeded 5 ppm then these cuttings, soils and fluids, were placed in 55 gal drums, labeled and retained on Beloit Corporation property. If PID readings were less than 5 ppm, then these cuttings, mud and extraneous soils were contained in 55 gal drums and later disposed of on Beloit Corporation property. Toxicity Characteristic Leaching Procedure (TCLP) analysis will be performed on composites of the containerized cuttings, mud and soils ($\text{PID} \geq 5$ ppm) to determine appropriate disposal.

4.10 MONITORING WELL DEVELOPMENT

Monitoring wells (listed in Table 4-2 and shown on Drawing F1) to be used for groundwater quality sampling were developed by alternately surging and purging for a minimum of 30 min with a bailer. After completion of the surge and purge cycles, the well development was completed by purging a minimum of ten well volumes (five well volumes for wells that could be bailed dry) or purging until the pH and specific conductance of the purged water had stabilized. Wells were purged by use of a bailer, Keck pump or Grundfos pump. Development documentation is contained in Appendix H.

Purge water from development was contained in 55-gal drums and stored on-site at a drum staging area. Disposition of the purge water will be determined following Round 1 Sampling Analysis.

Information regarding well development was recorded and includes:

- Date and time
- Total well depth before and after development
- Depth to groundwater
- Time spent on development
- Volume of water removed
- Visual water turbidity before and after development
- Pumping rate during development
- pH and specific conductance readings

4.11 GROUNDWATER SAMPLING WHILE DRILLING

Five deep borings (DB1, DB2, DB3, DB4, and W22C) and two intermediate groundwater quality borings (W23B and IB1) were performed within the RI/FS boundaries. These borings were used to evaluate vertical and horizontal distribution of groundwater chemistry. The deep borings were drilled to a minimum depth of 100 ft and the intermediate borings to a minimum depth of 70 ft at the locations shown on Drawing F1. Depths actually drilled in the field were based on stratigraphy and groundwater sample screening results using a field GC. Drilling and groundwater sampling was discontinued at a boring when one of the following situations developed:

- When groundwater screening results indicated that VOCs were not present and the 100-ft (for deep borings) or 70-ft (for intermediate borings) minimum depth had been reached, sampled, and analyzed.
- When groundwater screening results indicated that VOCs were present and the minimum depth requirement of 100-ft (deep borings) or 70-ft (intermediate borings) had been achieved, and a minimum of two consecutive clean groundwater samples had been collected below the deepest VOC detection in that boring.

None of these borings were advanced into bedrock.

Dual-tube reverse circulation drilling methods were used to advance the groundwater quality borings. Due to the drilling methods used, split spoon samples could not be obtained. A boring log based on discharge drill cuttings was kept by the supervising geologist and can be found in Appendix D. During drilling, groundwater samples were collected every 10 ft, beginning at the water table. Three volumes of groundwater were purged at each sampling interval prior to sample collection. One volume consists of the standing column of groundwater within the inner tube of the dual tube drilling system. This volume was purged either by bailer, B-K pump or Grundfos pump, depending on conditions encountered at that interval. Groundwater samples were collected through the center of the drill string with a stainless steel bailer. Groundwater samples collected from the seven borings were analyzed for total VOCs with an in-field GC. The GC data from the groundwater samples was used to obtain a vertical profile of the groundwater quality beneath the site.

Equipment used to purge and sample groundwater was decontaminated prior to each sampling interval. Bailers were washed with an Alconox solution followed by triple rinsing with potable water. The B-K pump was washed with high

pressure hot water and the Grundfos pump was cycled with an Alconox solution followed by potable water.

Upon completion of each borehole, downhole geophysical logging was performed to obtain a natural gamma ray log. The natural gamma ray log of the borehole was used in conjunction with cuttings and grain size analyses for interpretation of subsurface soil stratigraphy.

Monitoring wells were installed in those borings where the GC results indicated the presence of VOCs. Screen placement was determined based on GC results, soil stratigraphy, and gamma ray response.

Drill cuttings, fluids, and purge water derived from the activities mentioned above were screened with an 11.7 eV PID in the field. Field GC analysis was also used to determine the disposition of materials derived from drilling and groundwater sampling.

Water quality borings in which monitoring wells were not installed were abandoned according to IEPA guidelines. Documentation of the abandonments are contained in Appendix B. Borings in which monitoring wells were installed with partial abandonments were abandoned with 3/8-in. bentonite chips or bentonite slurry to seal any confining units that were penetrated. Areas without confining units present were abandoned with 3/8-in. bentonite chips and natural caving.

4.12 LOCATION AND ELEVATION SURVEY

Horizontal and vertical control surveys were performed on September 21, 1992, by Land Surveys Limited of Verona, Wisconsin (IL registration no. 035-002742). New monitoring wells, soil borings, water quality borings, staff gauges, and the geotechnical boring were surveyed.

Horizontal controls for locations were made to an accuracy of ± 0.1 ft msl and tied into the state plane coordinate system. Vertical elevations for ground surface at each location were surveyed to an accuracy of ± 0.1 ft, MSL and for the top of protective casing and PVC to an accuracy of ± 0.01 ft MSL, as shown in Table 4-2.

4.13 WATER LEVEL MEASUREMENTS

Three rounds of water level measurements have been collected during the RI to date. Water levels were obtained by the use of an electronic water level indicator. Depth to water was measured from the top of casing and adjusted to MSL. The water level indicator was decontaminated with a TSP solution and rinsed with deionized water prior to each measurement.

4.14 HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivities were measured by baildown testing in water table wells and/or by air pressure methods in deeper piezometers (see Table 4-2 and Drawing F1 for wells and locations). The Bouwer and Rice Method (1976) was used to analyze the test data. The methods used were as follows:

- Measure water level with an electronic water level indicator from top of casing (TOC).
- Measure total depth of the well from TOC.
- Place the pressure transducer into the well and allow a minimum of 3 min for the probe to equilibrate to the water temperature and pressure.
- Install a 6-ft PVC bailer below static water level (water table wells and some piezometers).
- Install the well head pressure device to seal the well head (for piezometers only).
- Enter the reference water level measured earlier into the data logger and check the water level using the pressure transducer until the water level reading is stable.

The following is for piezometers using the air pressure method:

- After a stabilized water level reading is obtained from the pressure transducer, the well is pressurized with sufficient air pressure to displace several feet of water (0.4 PSI/ft of water).
- Air pressure is maintained until the water level reading from the transducer is constant.

- The air pressure is then instantaneously released while simultaneously starting the pressure transducer recorder in the log sampling mode.
- Data are downloaded from the data logger to a computer for analysis.

The following is for water table wells and some of the piezometers:

- At water table wells, a single bailer of groundwater is removed to lower the water level while simultaneously starting the data logger to record the pressure transducer readings.
- Data are downloaded from the data logger to a computer for analysis.

Wells known from development information to have low hydraulic conductivities were tested using the direct measurement method which is as follows:

- Record water level and total depth as stated above.
- Insert 6-ft PVC bailer, allow to fill with groundwater and immediately withdraw to lower water level in well.
- Record water level measurements with respect to time elapsed from withdrawal of bailer.
- Input data recorded into a computer for analysis.

4.15 ROUND 1 GROUNDWATER SAMPLING

Round 1 groundwater sampling was conducted from August 25 through 28, 1992 for those wells listed in Table 4-2, as shown on Drawing F1. Analytical results for Round 1 sampling are contained in Appendix I.

Groundwater sampling proceeded from wells expected to have the lowest contaminant concentrations (based upon observations during drilling and existing groundwater quality data), to the wells suspected of having the highest contaminant concentrations. Each sampled well was purged immediately prior to sampling using a submersible sampling pump or bailer.

Sampling was performed with either a stainless steel bailer or a Keck pump. The Keck pump was used to purge several deeper wells and to sample these wells for inorganic and indicator parameters. The pump was removed, and approximately 1

gallon of water was removed from the well with a stainless steel bailer. The stainless steel bailer was then used to collect VOC samples.

The volume of water removed from the wells was measured so that a minimum of three well casing volumes were removed. Specific conductance, temperature and pH were monitored for stabilization during purging. Samples taken from water table wells and piezometers by using a stainless steel bailer, were poured into sample bottles in a manner to create as little agitation as possible.

All samples were placed on ice from the time of sample collection. Preservation and filtering was generally completed from 15 to 30 minutes after sample collection. Samples were shipped to the analytical laboratory at the end of each day.

The sampling equipment and water level indicator were decontaminated between wells with a TSP detergent solution and rinsed with deionized water. Decontamination of the pump and tubing consisted of pumping the decontaminant solution into the wash tanks for several minutes. The pump was then moved into the rinse tank and pumping resumed with rinse water.

Groundwater sample blanks were collected by pumping deionized water through the sampling pump into the sample bottles. Matrix spike/matrix spike duplicate samples were collected using the same sampling device. Duplicate samples for volatile organics analysis were obtained by alternately filling VOC vials from the pump. The remainder of the sample was split between the principal sample and the duplicate sample. IEPA or their oversight contractor (Ebasco) collected split samples from several wells.

4.16 SURFACE WATER AND SEDIMENT INVESTIGATION

A visual inspection of site surface topography was conducted on August 17, 1992, in order to map and evaluate site surface drainage patterns. Drawing F3 shows the site surface drainage routes.

4.17 AIR QUALITY MONITORING

Air quality measurements were taken throughout the RI. A PID was used to screen soil samples to determine which samples taken from the soil borings would be submitted for laboratory analysis as stated in Section 4.4. A PID was also used to screen drill cuttings and purge water to determine later disposition and for general health and safety concerns for on-site personnel at areas of concern. An

on-site field barometer was also used to measure daily atmospheric pressure during soil gas sampling.

4.18 EQUIPMENT DECONTAMINATION PROCEDURES

A temporary decontamination facility (Drawing F1) was constructed on Beloit Corporation property for high pressure hot water washing of drilling equipment. The facility was constructed of heavy duty plastic (12 mil) with 6 in. x 6 in. wood timbers used to create berms to contain decontaminated water. Plywood was laid down for the drill rigs to drive on so the plastic would not be punctured. The decontamination facility sloped in a single direction which allowed construction of a sump so water could be pumped into a 1500 gal tank, that was kept at the site, when needed. The drilling equipment was high pressure hot water washed at the temporary decontamination facility prior to moving to each new boring locations, except between wells at nests, and prior to exiting the site.

Decontamination included hot water high pressure washing the drill rig, drilling equipment, and tools between boreholes, and detergent washing and water rinsing the split spoon samplers after each collected sample. Well materials were also hot water high pressure washed and wrapped in plastic until installed. The B-K pump used to purge water at the water quality borings was high pressure hot water washed.

Bailers, cables, and other miscellaneous tools were bucket washed in an Alconox solution and triple rinsed with potable water. Pumping systems used were decontaminated by running the Alconox solution through the pump and associated hosing for a minimum of three minutes followed by rinsing with potable water using the same procedure.

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FINDINGS AND PHYSICAL CHARACTERISTICS OF THE SITE

Findings from the surface geophysical survey, documentation of high capacity wells, and the surface water and sediment investigation, and physical characteristics such as topography, surface features, soils, geology, hydrogeology, and air quality are presented in this section to enhance the readers understanding of local geology, hydrogeology, potential source areas and potential migration pathways.

5.1 SOURCE CHARACTERIZATION

5.1.1 Summary of Findings of the Surface Geophysical Survey

Interpretation of the EM and Mag survey results collected from 1314 Watts Avenue (Rockton Excavating) and 800, 824, and 900 Watts Avenue (Soterion) have been directed toward two major goals: 1) to locate buried underground storage tanks; and, 2) to locate buried metallic objects such as 55-gal drums.

For survey details and figures, see the Fromm Applied Technology Report (1992), which is included in Appendix F.

5.1.1.1 Rockton Excavating - The 1314 Watts Avenue site consisted primarily of a large parking lot, a large building, and large amounts of surface metallic debris. The survey of this site did not indicate the obvious presence of any buried tanks or drums. An anomaly along the southern edge of the site is likely due to a steel culvert. Due to the large amount of metallic debris at this location, a large portion of the area behind the building could not be adequately surveyed. While it seems likely buried metal is present in this area, the source material could not be delineated.

5.1.1.2 Soterion - The Soterion site consisted primarily of several quonset huts, parking lot, and roadways. Many of the site's features are shown in Figure 7: 800 Watts - Site Map Showing Summary of Field Results. A mag survey was not conducted at this site due to the presence of the metal buildings.

The survey of the Soterion site revealed the likely presence of 12 buried metal objects. Of these, seven areas are likely not of significant concern in terms of potential contaminant sources, including: two concrete slabs with buried metal (likely reinforcing rod), a large meter, a large power pole, a steel frame for a blower, an old jeep, and a possible buried electrical conduit. The remaining five areas of greater concern, as shown on Figure 7 of Appendix F, include:

- A manhole, concrete slab, and underground pressure tank, found at the southeast corner of the building at 824 Watts Ave.
- An anomaly indicating buried metal, approximately 5 ft by 10 ft in size with a pipe leading to it, found midway between the buildings at 800 Watts and 824 Watts, and approximately 135 ft east of the west end of the buildings.
- An anomaly indicating buried metal, approximately 5 ft by 20 ft in size, found midway between the buildings at 800 Watts and 824 Watts, and approximately 55 ft east of the west end of the buildings.
- An iron grate, approximately 3 ft by 3 ft, covering a sewer or drain tile, found near the southeast corner of the building at 900 Watts Ave.
- a non-descriptive and unusually shaped anomaly, showing signs of buried metal, found south of the building at 800 Watts Ave, approximately 60 ft east of the west end of the building.

5.2 SITE PHYSICAL CHARACTERISTICS

5.2.1 Topography, Surface Features, and Soils

The current site topography is the result of fluvial erosional and depositional events. It has also been altered by sand and gravel mining, building and road construction, and disposal of foundry sands and excavation soils. Drawing F1 shows that ground surface slopes gently from the gravel pit area located east of the BCRC toward the City of Rockton to the south and toward the Rock River to the southwest and west. Surface elevations range from approximately 770 ft MSL, around the perimeter of the gravel pit located in the northeast part of the

study area, to slightly less than 726 ft MSL along the Rock River in the western part of the study area.

Soil borehole descriptions (Appendix D), which are based on visual soil descriptions, natural gamma ray responses, and grain size analysis show that the entire site is blanketed with anywhere from 1 to 4 ft of clayey, sandy silt soils, except where surface soils have been removed or buried. In the Winnebago and Boone County Soil Survey (1980), these soils, classified as poorly drained, are referred to as Comfrey - Selma soils. They have typically formed on floodplains and/or low stream terraces in recent alluvial and/or glacial outwash sediments. In those areas (gravel pit, around site buildings, and storage yards) where these soils have been removed, the exposed materials will most likely be the underlying silty sands and gravels, which are likely to be well drained.

5.2.2 Findings of the Surface Water and Sediment Investigation

On August 17, 1992, a Surface Water and Sediment Investigation was performed. Field observations have been summarized graphically on Drawing F3.

Primary drainage in the developed and active portions of the site area is by means of shallow swales along the streets of the residential neighborhood, the Soo Line railroad track, and the Beloit Corporation driveway. Most of these swales drain to a concrete lined swale along Prairie Hill Road, from which drainage is to the Rock River. Drainage along Watts Avenue, in the residential area, is southwestward, to a vertical culvert (i.e., dry well) at the corner of Watts Avenue and Dingman Drive. Swales in the residential area and along the Beloit Corporation driveway are grassed.

There are swales on both sides of the elevated railroad track. Swales on both sides are heavily vegetated by trees, shrubs, and herbaceous plants, such that water flow (toward Prairie Hill Road) is extremely limited, probably even during periods of heavy precipitation (e.g., early spring).

Surface drainage from the active portion of the Beloit Corporation is by sheet flow across gradually sloping surfaces. Drainage from some impervious surfaces (roofs, storage yards) is collected and routed by pipe to discharge culverts on the western side of the plant buildings. Drainage from the main plant building storage yards is to small isolated areas adjacent to the northern and southern storage yards. Drainage from the BCP roof forms two intermittent streams that feed into the adjacent bottomwoods west of the BCP. These streams dissipate runoff into a bed of jewelweed approximately 300 ft from the building.

Surface drainage from the BCRC is primarily to the west into the Rock River through a limestone rip-rap-lined meandering channel. Drainage from the main

parking lot is to a grassed swale on its southern side, and on to the woods to the west. Flow from in front of (south and east of) the BCP buildings is gradual to the lawn or to the railroad track area. The driveway acts as a divide, controlling which swale receives runoff.

West and south of the active BCP drainage primarily percolates into the ground, which is vegetated in most of these areas. If runoff occurs, it is by sheet flow; indications of drainage or erosion patterns were not observed.

The gravel pit is a self-contained drainage area. Only the vegetated perimeters of this property drain by sheet flow to swales along Blackhawk Boulevard or the railroad track. Although the main east-west road in the gravel pit area slopes to the railroad for its entire length, little drainage is directed by this route.

Drainage in the residential area is primarily by sheet flow across yards to swales along the streets and the railroad track. Drainage along Watts Avenue is to the southwest, ending in a vertical culvert (drywell) at 900 Watts Ave. Drainage along Blackhawk Boulevard and the Soo Line track is primarily to the south and southeast.

In summary, most drainage patterns are through vegetated routes. Surface runoff, if any, on the vegetated southern and western parts of the site is by sheet flow to the west, toward the Rock River bottomlands. Drainage in the residentially and industrially developed areas is carried by vegetated swales. These swales are vegetated with lawn grass in the residential areas and along the Beloit Corporation driveways. Other swales, especially those along the railroad track, are overgrown with trees, shrubs, and herbaceous plants. Observations did not indicate the development of major erosion patterns at the site.

5.2.3 Site Geology

The site is located over the ancestral Pecatonica/Sugar Bedrock Valley, where it merges with the Rock Bedrock Valley (Drawing B1). In general, sandy-loam soils in the vicinity of the site are underlain by multiple sequences of complex glacial outwash deposits that consist primarily of stratified, fine to coarse sand, silty sand, sand and gravel, silty sand and gravel, and lacustrine clays and silts. These glacial deposits are generally between 220 and 235 ft thick and lie unconformably on the Platteville dolomite and St. Peter sandstone bedrock aquifers. Drawing F1 shows the soil sample locations (soil boring logs are included in Appendix D) and the lines along which cross-sections A-A', B-B', C-C', D-D', and E-E' were prepared. These geologic cross-sections, presented in Drawings F4 and F5, illustrate local subsurface geology.

Although the glacial deposits beneath the site are several hundred ft thick, only the upper 100 to 120 ft will be discussed in this document. These glacial deposits consist of a coarse upper outwash and a fine to coarse lower outwash which are bounded below by a lacustrine clay deposit that appears to extend laterally over the site.

Soils in the upper 25 to 35 ft are dominated by glacial outwash sands and gravels containing varying proportions of sand, silt and clay. The depth to the base of this surficial outwash deposit ranges from 6.5 ft in well W17 to 50.0 ft in well W27. This unit ranges from 49 ft (W27) to 2.5 ft (W17) in thickness. Cross sections A-A', B-B', C-C', D-D' and E-E' show this upper outwash deposit (primarily the sands and gravels) to be uniformly distributed over the entire site except in the vicinity of well W18 and boring DB3 where the sands and gravels grade into and interstratify with fine to coarse sands. A grain-size analysis was performed on a representative soil sample collected from boring GB1, sample #4 between 15 and 17 ft. The USCS classification is SPGP. This sample confirms the low silt and clay content of this unit (i.e., less 4.8%). Grain size results are summarized in Table 5-4.

The surficial outwash sand and gravel deposit is underlain by glacial outwash deposits consisting primarily of fine to coarse sands and silty sands containing lenses of silt and clay. This fine grained unit is interbedded with and underlain by a lower sand and gravel outwash deposit. Depth to the base of this sequence of outwash deposits (defined as the top of the underlying clay - dark shading on cross sections) ranged from 90 ft in well W26C (DB4) to 65 ft in boring DB3. Cross sections A-A', B-B', C-C', D-D' and E-E' reveal that this fine grained outwash deposit extends laterally over the entire site, and that it ranges from 15 ft (W23B) to 60 ft (W26C, DB2 and W18) in thickness. The lower sand and gravel unit extends from north of well W23B, where it is approximately 50 ft thick, to the east where it grades into and interstratifies with sands containing varying proportions of silt and clay in the vicinity of well W18 and boring DB3, and to the south where it thins to approximately 5 ft at well W25C and 20 ft at well W26C. Grain size analyses were performed on representative soil samples collected at various depths within this deposit. The fine soil fraction is classified as SP-SM (GB1-samples 19, 23, and 26 Table 5-4) and SM (W18-sample 1 Table 5-4) with silt and clay content ranging from 10% to 13%, respectively. The lower sand and gravel unit is classified as SP/GP (DB2-sample 2) with a silt and clay content of 1.9%.

Underlying these glacial deposits at a depth of approximately 80 to 100 ft is a lean glacio-lacustrine clay deposit. It appears to extend laterally over the entire site (see dark shading on cross-sections A-A' and B-B' (Drawing F4) and cross-sections C-C', D-D', and E-E' (Drawing F5)). It varies in thickness from

approximately 10 ft in monitoring well W25C, approximately 40 ft in DB3, and approximately 80 ft in BCP wells WW441K and WW441L. The USCS classification is CL based on grain size analyses (Table 5-4). The ratio of silt to clay ranging from 0.22 (sample #3-DB4) to 1.05 (sample #4-DB2) and the range of liquid limits, 30 (sample #4-DB2 and sample #1-W23B) to 48 (sample #3-DB4), confirms the lean character of this clay.

5.2.4 Hydrogeology

The shallow aquifer identified at this site is the lower fine to coarse grained outwash unit which is bounded above by the sand and gravel outwash deposits and below by the clay unit. This section describes the configuration of the water table that lies within this aquifer and how groundwater moves through this local aquifer system, both vertically and horizontally.

5.2.4.1 Water Levels - Measurements of depth to water and calculated surface water (staff gauges) and groundwater elevations are listed in Table 5-2 (August 25, 1992, September 21, 1992 and November 12, 1992). In general, these data indicate that water levels were elevated in September and November, relative to the August measurements, possibly in response to recent precipitation. There is not sufficient data to report on seasonal water level trends at this time. Water table elevations for August and September have been plotted and contoured on Drawing F6 (August 25, 1992) and Drawing F7 (September 21, 1992). A multiple point interpolation method was used, in conjunction with surface topography and surface water elevations, to determine the location of the equipotential contours between well points. These drawings indicate that groundwater flows toward the northwest, west, southwest, south and southeast from an east-west trending groundwater high located in the northern portion of the site. Groundwater flow in the vicinity of the BCRC is to the northwest away from the groundwater divide toward the Rock River. Flow beneath the BCP is to the west, southwest, south and to the southeast. Flow beneath the FSDA is toward the "groundwater trough" shown on Drawings F7 and F8 to the southwest. Flow beneath the FSSA is toward the south and southwest. These water table maps also show that water is moving from the Rock River into the aquifer (recharging system) along the southwest portion of the site and from the aquifer (discharging system) into the Rock River along the northwest portion of the site.

In general, there appear to be several local factors influencing groundwater flow. The Rock River is apparently recharging the local groundwater system along the southwest portion of the site. Groundwater recharge flow moves from the river into the local aquifer system where it converges with the local groundwater flow system resulting in the development of the "groundwater trough". Movement of this surface water into the local groundwater flow system is most likely the result of surface water elevation differences across the dam identified in Drawing A1.

The difference in surface water elevation across this dam is approximately 9 ft during the dry season and 14 ft during the wet season. The gradient resulting from this elevation difference is sufficient to induce the movement of water on the upgradient side of the dam from the river into the local aquifer system. The sand and gravel pit in the northeast portion of the site appears to be a recharge zone for the surficial unconsolidated aquifer system which is discharging into the Rock River along the northwest portion of the site. The steepening of the groundwater gradient in the vicinity of monitoring wells W23B, W22C, and W14 is probably controlled by local geologic conditions. The water table intersects the fine grained outwash unit in the vicinity of wells W23B, W22C, and W14. The fact that these fine grained units probably have reduced porosities and permeabilities in contrast to the sands and gravels may explain the steepening of the water table. A more detailed discussion is provided in Section 5.2.4.3 Groundwater Flow.

5.2.4.2 Hydraulic Conductivity - In-situ hydraulic conductivities were estimated from baildown tests conducted at 21 newly installed monitoring wells and five existing monitoring wells. A summary of data methods and raw results are contained in Appendix J. Table 5-1 is a summary of calculated hydraulic conductivities. These tests measured hydraulic conductivity in the vicinity of the well screen, and individual test results may not be representative of the entire aquifer. Data were analyzed using methods described by Bouwer and Rice (1976) and Bouwer (1989). Based on soils classified according to USCS methodology, in-situ hydraulic conductivities of the more prominent lithologic types of this aquifer ranged from 1.0×10^{-2} cm/sec to 3.03×10^{-3} cm/sec for clean sands, 4.56×10^{-5} cm/sec to 1.28×10^{-2} cm/sec for silts and sands with fines, and 9.6×10^{-6} cm/sec to 1.1×10^{-2} cm/sec for gravels, and sands and gravels.

With these hydraulic conductivity values, detail soil descriptions, and the configuration of the water table, it was possible to identify, in a qualitative sense, potentially high permeability zones (unshaded areas on cross sections), medium permeability zones (lightly shaded areas on the cross sections), and low permeability zones (darkly shaded areas on the cross sections). The rate of groundwater flow through high permeability zones is likely to be greater than through the intermediate and low permeability zones.

5.2.4.3 Groundwater Flow -

5.2.4.3.1 Horizontal Flow - Based on water levels obtained on August 25, 1992 (Table 5-2), the horizontal groundwater gradient ranged from approximately 0.003 ft/ft in the southern portion of the site to 0.005 ft/ft across water table contours 724, 725, 726 and 727 south of the BCP.

The steepening (contours closer together) of the horizontal gradient (from 0.003 ft/ft to 0.005 ft/ft) along a region that includes the northwest - southeast trending

segments of the 724, 725, and 726 ft water table contours (Drawing F6) and 724, 725, 726, and 727 ft water table contours (Drawing F7) may be related to the fact that groundwater is moving from the higher permeability sand and gravel zone into the lower permeability fine grained zone. This is illustrated in two dimensions on cross section A-A' (Drawing F4) between well nest W23 and production well WW441G. The lower hydraulic conductivities of the lower permeability fine grained zone (Table 5-1) may influence the horizontal flow and the direction of the steeper horizontal gradients observed across this area.

Based on Darcy's Law,

$$Q = K \cdot \frac{dh}{dl} \cdot A \quad \text{or} \quad K = \frac{Q}{A} \cdot \frac{dh}{dl}$$

a decrease in hydraulic conductivity (K) will result in a greater head loss (dh) over the same distance (dl), assuming a constant flow rate (Q) and area A. Therefore, as groundwater flows from higher conductivity deposits into lower conductivity (fine grained) deposits, more head loss would occur over the same distance in the fine grained deposit, resulting in a water table configuration as shown in Drawings F6 and F7.

5.2.4.3.2 Horizontal Groundwater Flow Rates - Horizontal groundwater flow was computed for each of the 11 soil types identified at this site (Table 5-2), using a horizontal gradient of 0.003 ft/ft, porosities of 0.25, 0.3, and 0.35, and computed geometric mean hydraulic conductivities. Flow rates ranged from a low of 0.1 ft/yr for the silty sand and gravel to a high of 145.9 ft/yr for sand. The following equation was used to make these computations.

$$\text{Velocity} = \frac{K \cdot \Delta L}{P}$$

Where: K = hydraulic conductivity (ft/sec)
 ΔL = hydraulic gradient (ft/ft)
P = effective porosity of the
aquifer material

5.2.4.3.3 Vertical Groundwater Flow Rates - Vertical hydraulic gradients at well nests were calculated based on groundwater level measurements made on August 25, 1992, and September 21, 1992. Results of the calculations are presented in Table 5-3. The highest observed vertical gradients (up to 0.09 at well nest W23) were downward. Vertical gradients decrease away from monitoring well nest W23. The change in downward vertical gradients at well nest 23 is most likely due to the physical influences of the groundwater divide. Downward vertical gradients are steepest along the axis of the groundwater divide and

decrease with increasing distance from the axis. The downward vertical gradients at well nest 23 probably increase as the axis of the groundwater divide moves closer to the well nest and decrease as the axis of the groundwater divide moves away from the well nest. Gradients are generally downward in the site vicinity, with only one upward gradient (+0.01 at well nest W19). There were no gradient reversals observed between the two sampling dates. The observed upward gradient is likely the result of recharge from the Rock River, a localized effect.

5.2.5 Documentation of High Capacity Wells

Five high capacity wells were found to exist within approximately 2 miles of the site. These included City of Rockton production wells no. 5 and no. 6 and Beloit Corporation production wells 441G, 441K, and newly installed production well 441L. City production wells 1, 2, 3, and 4 were abandoned in the 50s and early 60s (personal communication with Public Works Director for the City of Rockton) and Beloit Corporation production well 441E was abandoned in 1990. Borehole descriptions are provided for the Beloit Corporation wells (Appendix D) and City of Rockton production well no. 5 (Appendix D). Several attempts were made to obtain a log for City of Rockton production well no. 6. No log could be found. The Beloit Corporation wells can produce between 300 and 400 gallons per minute (gpm). The screened interval for existing production wells 441G, 441K, and 441L are shown on cross section B-B' (Drawing F4). The City of Rockton production well no. 5 can produce approximately 500 to 750 gpm (personal communication - City of Rockton Public Works Director). It is completed to a depth of 120 ft in a sand and gravel aquifer. As mentioned previously no borehole or well detail logs could be located for the City of Rockton production well no. 6. Production well no. 6 can produce 750 gpm, however, it is only run at 500 gpm to reduce sand production. This well is completed in bedrock to a total depth of 728 ft. The maximum drawdown, for the pumping rates described above, in production well no. 5 is 20 ft and in production well no. 6 is 50 ft. These two wells are identified on Drawing A1.

5.2.6 Findings of the Air Quality Assessment

Air quality was monitored at each drilling site throughout the course of the Phase I Investigation with a PID. It was concluded, based on a review of the PID screening results, that air is not a migration pathway.

[mad-606-198e]

CHEMICAL CHARACTERIZATION

This section provides a summary of the analytical results for samples collected at the site during July and August 1992. Compounds detected and the concentrations found are discussed in relation to the site. Analytical results for each matrix (soil, water, and soil gas) are contained in Appendix I.

6.1 NATURE AND EXTENT

6.1.1 Sampling and Analysis

Groundwater monitoring wells, private drinking water wells, and soil boring samples were collected at the site. Private well samples were collected from July 7 to July 22, 1992. Soil boring samples were collected from July 14 to August 5, 1992. Groundwater samples were collected from August 25 to August 28, 1992. Private well samples were analyzed for TCL VOCs, and selected samples for semivolatile organic compounds (SVOC). Groundwater and soil boring samples were analyzed for TCL and target analyte list (TAL) parameters. Groundwater samples were also analyzed for water quality indicator parameters.

6.1.2 Site Areas

As discussed in Section 5.2 of the Work Plan, several potential areas have been identified for investigation. These areas include:

- The Foundry Sand Disposal Area (FSDA)
- The Beloit Corporation Storage Yard Area (SYA)
- The abandoned waste water treatment ponds
- The Fiber Sludge Spreading Area (FSSA)
- Soterion
- Blackhawk Acres Subdivision
- The gravel pit

- Rockton Excavating
- The Beloit Corporation Research Center (BCRC)
- The Beloit Corporation Plant (BCP)

The discussion of contaminant nature and extent for soils has been organized based on these areas.

6.1.3 Contaminant Groupings

In order to facilitate the discussion of organic contaminants present at the site, compounds have been categorized into major groups based on structure, and chemical properties. The following groupings present organic compounds detected in various media at the site. Abbreviations used for each compound name are presented.

6.1.3.1 Compounds Utilized in Beloit Corporation Manufacturing Processes -

The Beloit Corporation is a manufacturer of machines that produce layered paper products from paper pulp. Solvent use at the Beloit Corporation Plant is limited to parts cleaning. This may have included the use of metal degreasing solutions, formulated with chlorinated volatile solvents. The exact composition of these degreasers is unknown.

6.1.3.2 Volatiles - VOCs detected at the site can be broken into four groups: chlorinated alkanes, chlorinated alkenes, aromatics, and ketones.

- Chlorinated alkanes - The chlorinated alkanes include compounds based on both ethyl and methyl groups. The ethanes are common industrial solvents and represent a potential degradation sequence, through the sequential loss of chlorine atoms. Whether the chlorinated alkanes detected at the site were present in the source product, or are due to degradation, cannot be determined. Chlorinated alkanes detected at the site include:

1,1,1-Trichloroethane (1,1,1-TCA)
1,1-Dichloroethane (1,1-DCA)
1,2-Dichloroethane (1,2-DCA)
Chloromethane

- Chlorinated alkenes - These compounds are common industrial solvents, and represent a potential degradation sequence. Whether the chlorinated alkenes detected at the site were present in the source product, or are due to degradation, cannot be determined.

Tetrachloroethene (PCE)

Trichloroethene (TCE)

1,1-Dichloroethene (1,1-DCE)

1,2-Dichloroethene (1,2-DCE)

- **Aromatics** - benzene, ethylbenzene, xylene, toluene (BEXT), chlorobenzene, and semivolatile compound 1,4-dichlorobenzene. The BEXT compounds are partially water soluble products from gasoline and other hydrocarbon products. 1,4-dichlorobenzene is used as a soil fumigant, in moth balls, and in disinfecting blocks (such as urinal cakes and recreational vehicle sanitary systems). All these compounds are used as solvents and reagents for a variety of manufacturing processes.
- **Ketones** - acetone, 2-butanone (also known as methyl ethyl ketone or MEK), 4-methyl-2-pentanone (methyl isobutyl ketone or MIBK), and 2-hexanone. These compounds are common solvents, used in paints, cement adhesives, resins, and cleaning fluids.

6.1.3.3 Semivolatiles -

- **Phenols** - phenol, 2-methylphenol (o-cresol), 4-methylphenol (p-cresol), 2,4-dimethylphenol, and 4-nitrophenol. Phenols are used in adhesives, epoxies, plastics, and a variety of synthetic fibers and dyes.
- **PAHs** - Polynuclear Aromatic Hydrocarbons (PAHs), including naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene, benzo(a,h)anthracene, and benzo(g,h,i)perylene. This group of compounds is associated with and derived from coal and oil, and the incomplete combustion of carbonaceous materials.
- **Phthalates** - diethylphthalate, di-n-butylphthalate, butylbenzylphthalate, bis(2-ethylhexyl)phthalate, and di-n-octyl phthalate. These compounds are associated with plastics and plastic making processes.
- **PCBs** - Polychlorinated biphenyls (PCBs) reported as aroclors 1248, 1254, and 1260. Reported results are for mixtures of PCBs identified and sold under the trade name aroclors, formerly used extensively in industrial applications.

6.1.4 Background Sampling, Analysis, and Evaluation

Background groundwater samples were collected at the following well locations:

G107
W11R

W8R
W24

These wells are all located upgradient of the site. Results for inorganic compounds detected in these samples will be compared to site-related sample results by comparing the mean plus two times the standard deviation of the background sample results to the site-related sample results. Metals detected in site-related groundwater samples at concentrations greater than the mean plus two times the standard deviation of the background samples will be considered present above background.

Background soil conditions are represented by soil samples SUSB107-00 and SUSB30-00. Surface soil sample SUSB107-00 was collected at the location of monitoring well G107, located north of the site across Prairie Hill Road. Surface soil sample SUSB30-00 was collected south of Prairie Hill Road, and north of the gravel pit. These locations were determined to be outside the influence of site-related activities.

Because the number of background samples analyzed for soil (2) is less than that required (4 to 7 background samples at locations determined as not being affected by anthropogenic sources, either site-related or ubiquitous) to perform the required statistical analysis, no assessment of the influence of site-related activities on metal concentrations in site soils can be made with the data collected for this Technical Memorandum. Metals data will be presented in the tables without interpretation in the text. The required additional background samples will be collected during Phase II. Assessment of background conditions will be presented in the RI report.

6.1.5 Field Screening Results

Field screening of groundwater and soil gas is a useful tool for locating areas in need of further characterization. In general, there is very good agreement between the field screening and laboratory results. However, the accuracy and precision of the sampling and analysis of the screening method does not allow these results to be directly compared to laboratory analytical data generated using CLP methodology. The screening results provide valuable information about site conditions, with an acceptable degree of confidence.

6.1.6 Soil Gas Field Screening Results

Soil gas samples were collected from locations around the site, and analyzed on-site for target VOCs by gas chromatography. Analytical results have been organized by area and are presented in Table 6-1. Soil gas sampling locations are presented in Drawing F2.

The soil gas survey results showed the BCP and SYA as potential source areas requiring further study. Other less significant areas of contamination based on the soil gas survey include southwest of Rockton Excavating, north of BCRC (SG-62, SG-63) and the FSDA (SG-10).

Concentrations of VOCs were found in the soil gas samples from the SYA. Compounds detected include chlorinated alkenes, chlorinated alkanes, and aromatics. Chlorinated alkenes detected include PCE, at concentrations of 2 to 50 ug/L, and 1,2-DCE at 0.5 ug/L. The chlorinated alkane 1,1,1-TCA was detected at 1 to 14 ug/L, while the aromatic compound toluene was detected at 0.3 to 0.5 ug/L. VOCs were detected along the southern edge of the SYA. In particular SG-107, at the southeast corner, contained PCE at 27 ug/L and 1,1,1-TCA at 14 ug/L. SG-131, to the west of SG-107, contained PCE at 40 ug/L. SG-130, located outside the SYA border and south of SG-131, contained PCE at 47 ug/L. Other samples in the vicinity contained lower concentrations of these compounds.

These same compounds were also detected in soil gas samples SG32, at approximately the midpoint of the south perimeter of the BCP and SG-36, at the southeast corner of the BCP. Chlorinated alkenes detected at SG-32 include PCE at a maximum concentration of 56 ug/L, TCE at 2.9 ug/L, and 1,2-DCE at 10 ug/L. Chlorinated alkanes detected include 1,1,1-TCA at 1.1 ug/L, and 1,1-DCA at 5.4 ug/L. Toluene was detected at 0.66 ug/L. SG-36 contained PCE at 2.6 ug/L.

Soil gas sample SG-57, located south of Rockton Excavating and east of the railroad tracks, contained aromatic hydrocarbons commonly associated with petroleum products. Toluene, ethyl benzene, and xylenes were found at concentrations of 2 to 16 ug/L.

Toluene was also detected at 3.2 and 0.47 ug/L in samples SG-62 and SG-63, respectively, located north of the BCRC, between the BCRC and the abandoned wastewater treatment ponds.

Two soil gas samples were collected from the FSDA, one each from the north end (SG12) and south end (SG11) of the area. Because material had been recently added to the FSDA, samples were not taken from the center of the area. In addition, six soil gas samples were collected within a 100 ft perimeter of the FSDA. SG10, located approximately 50 ft from the south perimeter of the FSDA, had 1,1,1-TCA detected at a concentration of 0.29 ug/L. VOCs were not detected in the remaining samples.

VOCs were not detected in soil gas samples collected from Soterion, the FSSA, Rockton Excavating, the gravel pit, or Blackhawk Acres Subdivision.

6.1.7 Groundwater GC Field Screening Results

Groundwater samples were collected from deep borings DB1, DB2, DB3, and DB4, intermediate boring IB1, soil borings SB8, SB21, and monitoring well borings W22C, and W23. Samples were analyzed for target VOCs by the field GC screening procedure. A summary of results is presented in Table 6-2.

The reported detection limit (RDL) for groundwater screening is 5 ug/L, as stated in the Standard Operating Procedure (SOP) included in the QAPP. During the field screening, the GC operator reported detects below the RDL (not required per the SOP) to observers present during sampling and analysis. These detects below the RDL are included in this Technical Memorandum because they were written up in the original data reported to the IEPA. The validity of these GC results below the RDL is questionable, based on low concentrations of contaminants in the equipment blanks. Contamination may also have occurred by traces of compounds present at a given depth being carried down the boring during drilling.

Field screening of groundwater collected during monitoring well installation for the purpose of locating screens was conducted at a DQO of 2; the method states that all results are considered tentatively identified and estimated. Results below the RDL are qualified as J (estimated), and thus have a greater level of uncertainty than those above the RDL.

Results for DB1, located directly south of W3R, W5R, and W25C, indicate the presence of chlorinated alkanes and alkenes, as well as aromatics. Results were similar to VOC results for the indicated wells.

VOCs were not detected in samples from deep boring DB2, at 47 to 100 ft depths. DB2 is located midway between well nest W22 and well W12. This migration pathway in this area has not been fully delineated.

Groundwater samples from well W22C at depths of 49 ft to 91 ft were screened by field GC analysis. 1,1,1-TCA was detected at 59 ft at a concentration of 0.54 ug/L, and at 69 ft at 12 ug/L. This result was not confirmed by laboratory analysis of groundwater from the monitoring well subsequently installed.

Results for DB3, located directly north of Soterion showed concentrations of 1,1,1-TCA of 5.1 ug/L and 8.3 ug/L at depths of 111 ft and 139 ft, respectively. In addition, 1,1,1-TCA was detected at 1.4 ug/L(J), 2.7 ug/L(J), 0.3 ug/L(J), and 0.3 ug/L(J) at depths of 40 ft, 100 ft, 149 ft, and 159 ft, respectively. An equipment blank from the Grunfos pump taken with these samples contained 1,1,1-TCA at 0.3 ug/L(J). Attempts to confirm this contamination indicated the presence of the compound in a pump blank; however, subsequent sampling with a

bailer instead of the pump failed to completely verify all the detects as being due to contamination.

DB4, located adjacent to W26C, contained 1,1,1-TCA at concentrations of 1.1 ug/L(J), 1.3 ug/L(J), 2.9 ug/L(J), and 4.0 ug/L(J) at depths of 49 ft, 59 ft, 69 ft, and 78 ft, respectively. TCE was detected at 4.3 ug/L(J), 2.2 ug/L(J), 9.1 ug/L(J), and 7.3 ug/L(J) at depths of 49 ft, 59 ft, 69 ft, and 78 ft, respectively. These two compounds, which were not found in samples from 103 ft and 110 ft, were also detected in the CLP analysis of well W26C.

IB1, located at Rockton Excavating, contained 1,1,1-TCA concentrations of less than 1 ug/L at depths of 39 to 69 ft. Benzene and toluene were also detected at a concentration of 0.9 ug/L(J) and 0.7 ug/L(J), respectively, at a 39 ft depth.

Groundwater from SB8, located at Soterion, contained 1,1,1-TCA at 2.2 ug/L in water collected at a depth of 29 ft. This compound was not detected in the soil sample SB08 (see Table 6-3), which primarily contained ketones.

Groundwater from SB21, located at approximately the midpoint of the south perimeter of the BCP on the southern perimeter of the BCP contained PCE, 1,2-DCE, and 1,1-DCE, as well as 1,1,1-TCA. PCE was the major contaminant, found at a concentration of 145 ug/L at 26.3 ft. these compounds were also detected in wells w23 and w23b, located at the western corner of the plant, but at higher concentrations.

Groundwater from W23B was sampled at depths of 49 to 79 ft. PCE, TCE, 1,2-DCE, and 1,1,1-TCA were detected in these samples. The groundwater screening sample collected at a depth of 49 ft contained 1,1,1-TCA at 35.3 ug/L(J), 1,2-DCE at 199 ug/L(J), TCE at 68.0 ug/L(J), and PCE at 2570 ug/L. This sample was analyzed at a dilution factor of 1:50. Because the concentration of PCE exceeded the calibration range at a dilution of 1:50, the sample was re-analyzed at a 1:100 dilution for PCE only. As is the case with all chromatographic procedures, analysis of this sample at lower dilution factors (in order to achieve lower detection limits) could not be performed, in order to protect the instrument, and prevent carry-over contamination of subsequent samples. The dilution factor selected by the analyst is based on professional judgement, with the intent of having a response for the compound detected at the highest concentration between 50 to 100% of full scale. At 1:50, PCE was at 103% full scale. The compounds detected in these screening samples were similar to those found in the sample from the monitoring well, with the exception of 1,1-DCA (reported in the monitoring well sample, only) and 1,1-DCE (in the field screening sample at 49 ft). Groundwater screening samples from W23B at 59 ft and 79 ft depths had no detectable compounds.

Groundwater from W23 was also screened for VOCs. PCE was detected at an estimated concentration of 2420 ug/L at a dilution factor of 1:10. The calibration range for this compound was exceeded by 480%. PCE concentration in the re-analysis at a dilution factor of 1:100 was 3630 ug/L, or 73% full scale. No other compounds were detected in the analysis at 1:10 dilution factor (detection limits of $10 \times 5 = 50$ ug/L). PCE was also detected in the CLP analysis from the monitoring well installed in this boring.

6.1.8 Soil Analytical Results

Soil samples were collected at 17 locations, at depths varying from surface soil (0.5 ft) to 34 ft. Sample locations are presented on Drawing F1. Refer to Appendix D5 for information regarding specific soil boring logs. Analytical results for soil samples are summarized in Tables 6-3, 6-4, 6-5, and 6-6. Soil sample results are discussed on an area-specific basis.

6.1.8.1 FSDA - The following locations were sampled from the FSDA located west of the SYA:

SB12 SB13

Results for these samples indicate a zone of contamination 10 to 12 ft below the surface. VOCs detected in these samples include acetone, 1,1-DCA, and 1,1,1-TCA. Acetone was detected at 89 ug/kg at the soil surface, but was not found at depth. The chlorinated alkanes were detected at 3-15 ug/kg at depths of 12-14 ft.

SVOCs detected in these samples include PAHs, substituted phenols, and phthalates. The maximum detected concentrations were found at sample location SB12, at depths of 12 to 14 ft. Maximum total PAH concentrations of 721,000 ug/kg were found at SB12 at a depth of 14 ft. Phenols, including cresols and methyl-substituted cresols, were found at this location at concentrations of 170 to 580 ug/kg. Total PAH concentrations of up to 1,191 mg/kg were detected in SB13.

Pesticides and PCBs detected in soil samples include heptachlor (0.74 ug/kg), DDT (2.8 ug/kg), methoxychlor (130-150 ug/kg), endrin ketone (21-25 ug/kg), and the PCB aroclor-1260 at 25 ug/kg. All of these results are below the CRQL.

The CRQL for organic compounds represents a concentration that all laboratories and instruments must be able to achieve. In practice this limit is greater than the concentration detectable for most compounds. Concentrations for compounds detected below this level are considered estimated, because the instrument is not calibrated below the CRQL.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.2 Soterion - Samples were collected from Soterion at soil boring SB8. VOCs detected in these samples include primarily ketones and aromatics. Ketones detected include 2-butanone (also known as MEK) at 76 to 120 ug/kg, 4-methyl-2-pentanone (also known as MIBK) at 5 to 9 ug/kg, and 2-hexanone at 10 to 16 ug/kg. Aromatic hydrocarbons detected include benzene at 3 to 4 ug/kg, and toluene at 2 to 3 ug/kg.

SVOCs detected in these soils consist of low concentrations (below the CRQL) of the PAHs phenanthrene and pyrene. Low concentrations of PAHs are often detected in soils from developed areas, and are likely not related to site concerns. Pesticides and PCBs were not detected in samples from this area.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.3 Former FSSA - The following samples were collected from the former FSSA:

SB9

SB10

SB11

VOCs were not detected in these samples. Chloroform and 1,2-DCE, detected in fibrous sludge samples collected in 1986, were not found in this round of sampling.

SVOCs included one detect of 4-nitrophenol at an estimated concentration of 100 ug/kg. This compound was detected at the same concentration in the background sample, and may not be site related. In addition, BEHP in two samples and di-n-octyl phthalate in one sample (a related phthalate, reported in one sample) were found at estimated concentrations of 50 and 68, and 74 mg/kg, respectively. BEHP was found in the background sample at an estimated concentration of 100 ug/kg.

The soil sample from SB9 at 16 ft contained concentrations of heptachlor (1.0 ug/kg, estimated) and DDT (4.1 ug/kg). Given these compounds' tendency to be strongly adsorbed to the soil, it is unclear why these compounds would be present at depths of 16 ft, when they are absent near the surface.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples.

6.1.8.4 Beloit SYA - The following locations were sampled from the SYA:

SSB14 SG130

VOCs detected in these samples include acetone (67 ug/kg) and PCE (8 ug/kg) at surface soil location SG130. Soil gas screening analysis for the SYA showed numerous detects of VOCs in the area south of boring SB14, including PCE at 47 ug/L from SG130, but not north of SB14. It appears that an area or areas of soil contamination may exist in the storage yard area.

SVOCs were not detected, with the exception of phthalates, which were also found in the background sample at similar concentrations. Pesticides and PCBs were not detected.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.5 BCP - The following soil samples were collected from the BCP:

SB15 SB16 SB20
SB21

VOCs detected in these samples include the chlorinated alkane PCE and the aromatics ethylbenzene and xylenes. PCE was found in surface soil from SB21 at 4 ug/kg. Recall that soil gas screening results also detected PCE in sample SG-32. Xylenes were detected in SB20 at 3 ft at a concentration of 250 ug/kg, the only xylene detect found in any of the laboratory soil and water analyses.

SVOCs detected at locations SB20 and SB21 primarily include PAHs. 4-Nitrophenol, found at 60-99 ug/kg, was also detected in the background sample at 100 ug/kg. Phthalates detected include BEHP at background levels, and di-n-octyl phthalate at 120 ug/kg, below the CRQL. While di-n-octyl phthalate has been used at the plant, this single detect at the soil surface makes it unlikely this detect is related to site contamination, and is more likely the result of low level contamination by the laboratory. PAHs were detected in the surface soil samples, and in SB20 at 3 ft. Total PAH concentrations reached a maximum of 26,700 ug/kg in the field duplicate at SB21.

PCBs were detected in surface soils from this area, including aroclor-1254 and aroclor-1260. Concentrations are near or below the CRQLs. Pesticides detected in these samples include heptachlor and DDT. DDT and heptachlor were only found at depths of 22 ft in this area. These compounds are very strongly adsorbed to the soil, and would not be expected to migrate significantly. Given that heptachlor and DDT were not found at shallower depths, it is likely these results are due to laboratory glassware contamination, and are not site related.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.6 Rockton Excavating - Samples were collected from Rockton Excavating from soil boring SB17.

Chloroform was detected in sample SB17 at 1 ug/kg. No other VOCs were detected in these samples. Recall that 1,1,1-TCA was detected in groundwater screened from boring IB1 at 39 and 59 ft. SVOCs detected include phthalates and PAHs. Phthalates detected include di-n-butyl and butylbenzyl phthalate, as well as BEHP. The surface soil sample contained a total PAH concentration of 3,020 ug/kg. Pesticides and PCBs were not detected in these samples.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.7 Abandoned Waste Water Treatment Ponds - Samples were collected at the abandoned wastewater treatment ponds from soil boring SB18 at three depths.

Previous studies had indicated the presence of VOCs in samples from these ponds. The current sampling round did not find VOCs or SVOCs in the abandoned pond area, with the exception of BEHP (also found in background samples). The PCB aroclor-1254 was detected in the surface soil sample, at a concentration of 360 ug/kg.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.8.8 Gravel Pit - Samples were collected from the gravel pit at soil boring SB19 at three depths.

VOCs were not detected in any of these samples. With the exception of BEHP, SVOCs were not detected, either. The PCB aroclor 1248 was detected in the surface soil at 24 ug/kg, below the CRQL.

Inorganic (metals) data for samples from this area are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data can not be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

6.1.9 Groundwater Analytical Results

Samples collected from 32 groundwater monitoring wells were analyzed for TCL organics, TAL inorganics, and groundwater quality indicator parameters (alkalinity, chloride, sulfate, nitrate and nitrite-nitrogen, ammonia-nitrogen, total phenolics, and total dissolved solids). In addition, 55 private wells, 53 in the Blackhawk Acres Subdivision and two on Prairie Road, were sampled and analyzed for low concentration TCL VOCs. Of these 55 wells, six were chosen for SVOC analysis.

Analytical results for groundwater and private well samples are presented in Appendix I. VOC detects for monitoring and private wells are presented in Drawing F9. The results of analyses for organics, metals, and groundwater

quality indicator parameters at site monitoring wells are summarized in Tables 6-7, 6-8, and 6-9. Private well organics results are summarized in Table 6-10.

6.1.9.1 Groundwater Shallow Monitoring Wells - The following wells are screened at shallow depths of 730 to 710-ft elevations:

W3R	W13	W15
W16R	W17	W19
W20	W21	W22
W23	G104	G109
G110		

Monitoring well organics, metals, and groundwater quality indicator parameters results are summarized in Tables 6-7, 6-8, and 6-9.

VOCs detected in these wells include chlorinated alkanes and alkenes. Chlorinated alkanes detected include 1,1,1-TCA (2 to 24 ug/L) and 1,1-DCA (1 to 15 ug/L). Chlorinated alkenes detected include PCE (4 to 3,000 ug/L), TCE (2 to 19 ug/L), and 1,2-DCE (9 ug/L). U.S.EPA MCLs were exceeded for PCE at W3R, W5R, W20B, W21, W23 and W23B, and for TCE at W21, W23B, W26C, and W18 (see Table 6-7).

Well W23, located at the southwest corner of the BCP, had PCE detected at 3,000 ug/L, exceeding the MCL. The CLP laboratory (CompuChem) performed a 1:25 dilution on this sample, due to the elevated concentration of PCE, resulting in detection limits being increased by a factor of 25 to 250 ug/L. As is the case with all chromatographic procedures, analysis of this sample at lower dilution factors (in order to achieve lower detection limits) may adversely affect the instrument, and possibly result in carry-over contamination of subsequent samples. The dilution factor selected by the analyst is based on professional judgement, with the intent of having a response for the compound detected at the highest concentration between 50 to 100% of full scale. PCE in this sample was reported at 60% of full scale in the 1:25 dilution.

SVOCs were not detected in these groundwater samples.

The pesticide endrin ketone was reported in well G110 at 0.003 ug/L. This value is 3% of the 0.1 ug/L CRQL, and may be more representative of very low level laboratory contamination than site-related contamination. Endrin ketone is a breakdown product of endrin, which is routinely used by the laboratory as a matrix spiking compound.

MCLs for metals were exceeded for cadmium in well W3R-01 (5 ug/L) and for nickel in well W15-01 (877 ug/L). The MCL for cadmium is 5 ug/L and 100 ug/L for nickel. Background values are calculated as the mean plus two times the standard deviation of positive detect concentrations for a given metal in the four background samples (refer to Table 6-8 for specific sample concentrations and background values). Background values were exceeded in at least one sample for arsenic, barium, cadmium, copper, iron, magnesium, manganese, nickel, and silver. Aluminum, not found in the background samples, was found in W15 (62 ug/L). Arsenic, also not found in background, was detected in well G110 (2.3 ug/L). Barium exceeded background at W13 (69 ug/L) and W15 (229 ug/L). Cadmium, found in one background sample at 5 ug/L, was detected in W3R (5 ug/L). Copper, not found in background, was detected in W23 (15 ug/L). Iron, not found in background, was detected in W15 (98 ug/L), W16R (21 ug/L), G104 (30 ug/L), G109 (25 ug/L), and G110 (536 ug/L, and 869 ug/L in the field duplicate). Magnesium exceeded background in W15 (86,300 ug/L) and W23 (68,100 ug/L). Manganese exceeded background in W15 (286 ug/L) and G110 (334 ug/L). Nickel, not found in background, was detected at W15 (877 ug/L) and W23 (28 ug/L). Silver, found in one background sample at 10 ug/L, was detected in W13 (10 ug/L), and W15 (11 ug/L). Well W15 was the only location to exceed background for aluminum (62 ug/L), calcium (209,000 ug/L), potassium (8,540 ug/L), sodium (447,000 ug/L), and zinc (22 ug/L).

Groundwater quality indicator parameters and metals results for well W15-01 vary significantly from the other wells. Chloride results for the other 15 wells averaged 14 mg/L; while the chloride concentration at well W15 was 1,100 mg/L. Total dissolved solids results averaged 401 mg/L versus 2,410 mg/L for well W15. Metals results for this well were significantly elevated for aluminum, barium, calcium, manganese, nickel, potassium, and sodium. These results may be due to contamination of the well by road salt or some other material, or may be due to groundwater flow from the gravel pit or may be due to faulty well construction. Results for well W16R, located south of the gravel pit, did not show the contamination pattern present in well W15.

6.1.9.2 Groundwater Intermediate Monitoring Wells - The following wells are screened at an intermediate depth, between 710 to 680-ft MSL:

W5R	W14	W19B
W20B	W21B	W22B
W23B	G103D	G108D

VOCs detected in these wells include chlorinated alkanes and alkenes. Chlorinated alkanes include 1,1,1-TCA (8 to 47 ug/L), 1,2-DCA (320 ug/L), and

1,1-DCA (1 to 7 ug/L). In addition, carbon disulfide was detected in well W22B at 2 ug/L.

Well W23B, located at the southwest corner of the BCP, had PCE detected at 970 ug/L, approximately one third the concentration detected in W23, (screened at a shallower depth of 730-720 ft). TCE was found at 33 ug/L. Chlorinated alkanes detected include 1,1,1-TCA and 1,2-DCA at 47 and 320 ug/L, respectively. MCLs for 1,2-DCA, PCE, and TCE (5 ug/L for each compound) were exceeded at this location. The CLP laboratory (CompuChem) performed a 1:5.6 dilution on this sample, due to the elevated concentration of PCE (reported at 87% of full scale in the 1:5.6 dilution), resulting in detection limits being increased by a factor of 5.6 to 56 ug/L.

Well W21B, located south-southwest of W23B, had a detect of TCE at 2 ug/L; PCE was not detected. 1,1,1-TCA was detected at 25 ug/L. MCLs were not exceeded at this well.

Continuing away from the BCP, well W20B had detects of PCE at 6 ug/L and TCE at 5 ug/L. 1,1,1-TCA was detected at 8 ug/L. The MCL of 5 ug/L for TCE was exceeded at this location.

Well W05R, located farther from the BCP and W23B in the same rough line as W21B and W20B, had detects of PCE, TCE and 1,1-DCE at 12, 3, and 3 ug/L, respectively. Chlorinated alkanes detected include 1,1,1-TCA and 1,1-DCA at 45 and 7 ug/L, respectively. The MCL of 5 ug/L for PCE was exceeded at this location.

Well W22B, located near the east boundary of the Beloit property between the SYA and the former FSSA, had a detect of carbon disulfide at 2 ug/L. This compound was not detected in any other groundwater samples from the site (carbon disulfide was also detected in soil samples from SB08). No other VOCs were detected in the three samples from well nest W22.

Phthalates were the only SVOCs detected in these samples. Di-n-butylphthalate and diethylphthalate were detected at 1 to 2 ug/L, respectively. These low concentrations are likely the result of laboratory contamination.

The pesticide endrin ketone was reported in five samples at 0.002 to 0.004 ug/L. These values represent 2 to 4% of the 0.1 ug/L CRQL, and may be more representative of very low level laboratory contamination than site-related contamination.

The MCL for cadmium was exceeded at well W20B (5 ug/L). Cadmium was not detected in the field duplicate of this sample. Nickel was above the MCL at well W14-01 (305 ug/L).

Background values are calculated as the mean plus two times the standard deviation of positive detect concentrations for a given metal in the four background samples (refer to Table 6-8 for specific sample concentrations and background values). Background values were exceeded for cadmium, chromium, iron, lead, manganese, nickel, and zinc. In addition to the MCL exceedances listed above, nickel exceeded background at G108D (41 ug/L). Chromium was above background at G108D (15 ug/L). Iron exceeded background at wells W19B (51 ug/L), field duplicate W20B (58 ug/L), and G108D (97 ug/L). Lead, detected at well W5R (3.4 ug/L), was not detected in any other site wells. Manganese exceeded background at W19B (266 ug/L). Zinc exceeded background at G108D (26 ug/L).

6.1.9.3 Groundwater Deep Monitoring Wells - The following wells are screened at a depth below the 680 ft elevation:

W18 W22C • W25C
W26C

VOCs detected in the deep wells include both chlorinated alkanes and alkenes. 1,1,1-TCA was found at concentrations of 4 to 16 ug/L in all wells except W22C. TCE was found at concentrations of 1 to 61 ug/L in all wells except W22C.

Well W22C, the deep well located closest to the BCP, had no detects of VOCs. Well W18, located south of well nest W22, contained 1,1,1-TCA at 4 ug/L; TCE was detected at 24 ug/L, exceeding the MCL of 5 ug/L.

Well W25C, located in the vicinity of intermediate well W05R and shallow wells W03R and W104, had detects of 1,1,1-TCA and TCE at concentrations of 10 and 1 ug/L, respectively.

Well W26C, located approximately 300 ft north of the southeast corner of the Beloit property, had detects of 1,1,1-TCA at 16 ug/L, and PCE at 61 ug/L. The MCL of 5 ug/L for PCE was exceeded at this location.

Phthalates were the only SVOCs detected in the deep wells. Phthalates detected include di-n-butyl, diethyl, and dimethylphthalate, at concentrations ranging from 1 to 2 ug/L. Again, these low concentrations (below the CRQL) may be the result of sample contamination.

The pesticide endrin ketone was reported in one sample at 0.005 ug/L, 5 % of the 0.1 ug/L CRQL. As discussed above, this detect may represent low level laboratory contamination. Heptachlor was detected in the sample from well W26C at 0.2 ug/L. This value is above the CRQL.

Background values are calculated as the mean plus two times the standard deviation of positive detect concentrations for a given metal in the four background samples (refer to Table 6-8 for specific sample concentrations and background values). Background values were exceeded for iron and cyanide in the deep wells. Iron was above background in the field duplicate W18 (32 ug/L), but was not detected in the original sample. Cyanide was detected at two locations, W18 and W26C, at concentrations of 5 to 9 ug/L, respectively. These wells are located on the Beloit Corporation boundary, east and south of the FSSA.

6.1.9.4 Private Wells - Fifty-five private wells were sampled and analyzed for low concentration VOCs. Of these, 19 private wells had reported VOC detects. Compounds detected include chlorinated alkanes, chlorinated alkenes, and the trihalomethane chloroform. In addition, a single detect of 1-4-Dichlorobenzene was reported. VOC detects for private wells are included in Drawing F8. Private well locations having reported VOC detects are summarized in Table 6-10.

Blackhawk Subdivision Private Wells

Chlorinated alkanes detected include 1,1,1-TCA in 7 wells (0.5 to 25 ug/L), 1,1-DCA in 4 wells (0.6 to 3 ug/L), and chloromethane in 1 well (0.9 ug/L). Chlorinated alkenes detected include PCE in 7 wells (0.5 to 86 ug/L), TCE in 5 wells (0.5 to 14 ug/L), and 1,1-DCE in 2 wells (2 to 3 ug/L). Chloroform was detected in 8 wells at concentrations of 0.6 to 10 ug/L.

The MCL for TCE (5 ug/L) was exceeded in well PW50, located at 1102 Blackhawk Boulevard. The MCL for PCE (5 ug/L) was exceeded at two locations; PW2, located at 914 Watts Avenue, and at PW4, located at 910 Watts Avenue.

The VOC analysis also included a scan for Tentatively Identified Compounds (TICs). This is a search to identify any unknown compounds that are detected during the analysis. The sample from well PW51 (located at 407 Central) contained one TIC, identified as trichlorobenzene, at an estimated concentration of 1 ug/L. The TIC library search could not specify the isomer. 1,2,4-Trichlorobenzene has an MCL of 70 ug/L, and is included as a TCL SVOC, while the 1,3,5-trichlorobenzene isomer is not regulated or included on the TCL. This sample was not analyzed for SVOCs.

Prairie Road Private Wells

Wells from 900 and 903 North Prairie Road (sample numbers PW53 and PW54, respectively) were analyzed for VOCs. 1,4-Dichlorobenzene was detected in PW53 at an estimated concentration of 0.6 ug/L. This compound was not detected in any other samples from this investigation. No other detects were reported for these samples.

The following private well samples were analyzed for low concentration SVOCs:

<u>Well ID</u>	<u>Address</u>
PW1	909 Watts
PW2	914 Watts
PW4	910 Watts
PW7	1004 Watts
PW17	1314 Watts
PW53	900 N. Prairie

SVOCs were not detected in any of these private well samples.

Private well contaminants can be separated into two groups, chlorinated VOCs and chloroform. The source of both these groups is unclear. No chloroform source has been identified to explain the presence of the compound in the private wells. While a chlorinated VOC source is present at the BCP, the pathway to the Subdivision has not been established, based on the lack of VOC detects in boring DB2, wells W13, W14, and well nest W22.

[mad-606-198f]

CONTAMINANT FATE AND TRANSPORT

This section provides a review of physical and chemical mechanisms that may affect the behavior of site contaminants identified in Section 6. Migration pathways are identified, and the fate and migration of specific contaminants found in groundwater and soils are discussed.

7.1 PHYSICAL/CHEMICAL ATTENUATION MECHANISMS

The primary mechanism affecting the migration of contaminants in groundwater is the physical flow of the groundwater (advective transport). In addition, the fate and migration of organic and inorganic contaminants in the subsurface environment can be affected by chemical and physical mechanisms. A mechanism may cause a contaminant to remain in solution, precipitate out of solution, be adsorbed to a surface, or transform or degrade into another compound. The following discussion summarizes each of the potential mechanisms involved.

7.1.1 Dilution/Attenuation

A non-reactive species introduced into groundwater or surface water would decrease in concentration as it is transported away from the source. This dilution attenuation of a chemical is independent of any chemical mechanism affecting concentration over distance. Chloride is a non-reactive indicator species affected primarily by dilution.

7.1.2 Adsorption/Desorption

Organic contaminants may be adsorbed or desorbed by organic matter and soil, strongly influencing the rate of migration. Strongly adsorbed contaminants are relatively immobile and will resist being leached or transported. The amount of a chemical that will be adsorbed is a function of the properties of the chemical in question, the geological matrix, and the hydrological environment.

Hydrophobic organic compounds dissolved in aqueous solutions will tend to adsorb onto solid phases that the water contacts. The amount of contaminant that is adsorbed is a function of soil grain size, mineral composition, organic content, solute composition, and solute concentration. However, of the variety of soil components that can influence rates of adsorption for organic contaminants, organic carbon content is generally the most significant. Based on a chemical's organic carbon/water partition coefficient (K_{oc}), and the soil organic carbon content (f_{oc}), the relative affinity of a compound for a soil matrix can be estimated. This, in turn, can provide an estimate of the transport rates for various chemicals. The retardation factor (R_f) of a chemical describes the effect of sorption in decreasing the rate of contaminant transport in the liquid phase, relative to a non-reactive species ($R_f = 1$). A nonreactive species, such as chloride, would have a transport rate equal to the groundwater flow. A secondary influence of adsorption on the fate of groundwater contaminants is the retention of organic chemicals near the source area, where biological and chemical degradation may be enhanced by the presence of a carbon source or bacteria.

The retardation factor is calculated as follows:

$$R_f = 1 + (P_b/n) \times K_d$$

Where:

- R_f = Retardation Factor (unitless)
- P_b = aquifer bulk density (g/cm^3)
- n = effective porosity (unitless)
- K_d = distribution coefficient (ml/g)

and

$$K_d = K_{oc} \times f_{oc}$$

where:

- K_{oc} = organic carbon partition coefficient
- f_{oc} = organic carbon fraction

Aquifer bulk density (P_b) and effective porosity (n) are assumed to be $1.8 g/cm^3$, and 0.3 respectively; typical values for sand and gravel soils. The organic carbon fraction (f_{oc}) is assumed to be 0.1%. Given the differences of the various geological units present at the site, these values were assumed to represent average conditions in the aquifer and provide estimates of the effective rate of transport for various chemicals detected at Beloit Corporation. Retardation factors calculated in this manner are presented in Table 7-1, along with chemical and physical properties of chemicals detected at the site. Retardation factors for PCE and 1,1,1-TCA are 3.2 and 1.9, respectively. Therefore, 1,1,1-TCA would

be expected to travel quicker through the aquifer than PCE. PAHs, with retardation factors 1,000 times higher, would be expected to move very slowly.

Inorganic elements have multiple valence states exhibiting different adsorption behavior. Hydrogeochemical conditions affect how each chemical contaminant reacts. Adsorption will vary depending on pH and Eh conditions, and on competing ion species present. Geological matrix components such as hydrous metal oxides (Fe, Mn), amorphous aluminosilicates, layer lattice silicates (clays), and organic matter all provide significant adsorptive surfaces. These surfaces adsorb contaminants through a pH dependent charge. Decreasing groundwater pH generally increases positive charge and favors anion retention, while increasing pH favors cation adsorption. Uncomplexed ions tend to be preferentially adsorbed over complexed ions.

Considerable descriptive and qualitative information is available for some elements, however, it is not possible to reasonably predict adsorption behavior quantitatively based on mineralogy and groundwater composition (Battelle, 1984). The synergistic effect of pH, Eh, complexing ions, and competing ions on adsorption varies between contaminants and matrix materials and was beyond the scope of this investigation. Generalizations and broad groupings of elements with similar geochemical behavior can be made, however while metals were detected in some soil samples they do not appear to present a substantial groundwater problem at the site.

7.1.3 Biodegradation

Biodegradation may be an important fate mechanism for organic constituents under proper conditions. Biodegradation can result in partial or complete reduction of contaminant concentrations, and the production of microbial cells, water and carbon dioxide. The contaminant is transformed in the presence of an electron acceptor; oxygen in aerobic conditions, and nitrogen, sulfate or carbon dioxide in anaerobic environments. Research indicates the biodegradation of related organic compounds varies with the nature of the compounds and the surrounding chemical environment. For example, biodegradation of BETXs (aromatic hydrocarbons) occurs most readily under aerobic conditions present in the vadose zone, where as PCE and TCE (chlorinated ethenes) tend to degrade more readily under anaerobic conditions within the aquifer. Other persistent contaminants such as PCBs may resist biodegradation.

Microbially mediated reductive dechlorination has been identified as a likely degradation mechanism for chlorinated alkanes and alkenes in groundwater systems (Bouwer and McCarty, 1983, 1983a, Parsons et al., 1987, 1987a). Through this mechanism chlorinated alkenes such as PCE will degrade to TCE, which will further degrade to 1,2-DCE or similar compounds. Chlorinated

ethanes, such as tetrachloroethene or 1,1,1-TCA will degrade to 1,2-DCA. The rate of degradation is related to the availability of a non-chlorinated carbon source (as a nutrient for the bacteria), pH, temperature, compound concentration, and the presence of microbial toxicants. Some degree of biodegradation of organic contaminants present at the site is likely occurring as evidenced by the presence of potential degradation products (such as 1,2-DCE). However, attempts to quantitate the level of biological activity, or evaluate the potential for enhancement of biodegradation as a remedial alternative was not within the scope of this phase of investigation. Because of uncertainty in identifying the initial source product composition, the effects of biodegradation of contaminants cannot be determined.

7.1.4 Volatilization

Loss of organic contaminants from the site through volatilization is dependent on site factors including soil porosity, moisture content, nature of the surface, and climatic conditions such as temperature and wind speed. Volatilization is also dependent on contaminant specific properties such as Henry's Law constant and diffusivity. The process involves desorption of the contaminant from the soil into the soil water, diffusion into the water, interphase mass transfer between the water and the air, diffusion out of the soil pores and into the ambient air.

The presence of this mechanism is evidenced by the soil gas results discussed in the previous sections. However, because of the uncertainty associated with soil gas screening performed at a data quality objective (DQO) level 2 (as described in the QAPP), the degree to which volatilization might potentially reduce contaminant concentrations in soil cannot be calculated using this data.

7.1.5 Precipitation

The solubility of metal species present in the aquifer matrix controls precipitation of metal contaminants in groundwater. The thermodynamic behavior of various species may be used to predict the most stable phase that will form in the environment. The evidence for the existence of solubility-controlling solid phases is often indirect, such as comparison of ion activity products to solubility products. Hydroxide and carbonate solids, stable at neutral to high pH values, often control precipitation rates.

7.1.6 Hydrolysis

Hydrolysis reactions occur between water and an ionic species in solution. Salts of weak acids and bases hydrolyze and may affect overall attenuation of various contaminants. Hydrolysis reactions may be catalyzed by acids, bases and selected metals. Hydrolysis is not a primary fate of contaminants, but may occur in specific environments.

7.2 CONTAMINANT SOURCE AND MIGRATION

Contaminants introduced to the environment represent a source, which can then migrate through a variety of pathways away from the source. Possible sources of contamination have been located at the BCP, FSDA, the SYA, and Soterion. The presence of additional sources are unknown. As discussed in Section 5.3, groundwater provides the primary migration pathway for contaminant transport at the site. The extent of migration of these contaminants in the groundwater is dependent on the interrelationship between site-specific geological and hydrochemical conditions, and the physical and chemical properties of the contaminant itself.

7.2.1 VOCs

Two potential sources of VOC contamination have been identified; in the vicinity of well nest W23 at the BCP, and Soterion. Chlorinated VOCs are primarily found at the BCP and aromatic VOCs at Soterion. Soil gas screening results and soil analytical results, as described in Sections 6.1.6 and 6.1.8.4, indicate that other areas exist in Beloit Corporation's SYA that may require further evaluation. It is possible other contaminant sources may exist, however, locations of other potential source areas cannot be determined based on the data collected to date.

The VOC source on the Beloit Corporation property appears to be located at the southwest end of the BCP in the vicinity of well nest W23 (Drawing F1). Given that groundwater flows away from the BCP, a potential source for VOC contamination in this area lies beneath the BCP building. VOCs detected in well nest W23 include PCE at both shallow depth in well W23 and at intermediate depth in well W23B. TCE, 1,1,1-TCA, and 1,2-DCA were only found at an intermediate depth in well W23B.

Utilizing the current configuration of the water table (Drawings F6 and F7) VOCs can be traced from well W19 back to well nest W23 through wells W25C, W3R, W5R, W20R, W20B, W21 and W21B. Cross section B-B' in Drawing F4 shows the geology and the location of the well screens for the aforementioned wells. VOCs appear to enter groundwater in the vicinity of well nest W23. The vertical gradient in the vicinity of well nest 23 appears to be driving some VOCs down into the lower sand and gravel aquifer and then the horizontal component of flow is moving the VOCs downgradient to the south. Groundwater quality screening beneath the clay in water quality boring DB1 (now instrumented with well W25C) and DB4 (now instrumented with well W26C) have shown no detection of VOCs indicating that the VOCs may be restricted to this upper aquifer. The path of the western plume, along the "groundwater trough" running south from the BCP, shows the following total VOC concentrations (in ug/L) as distance from the BCP, represented by results for well nest W23, increases:

<u>Well</u>	<u>Screen Interval (El.-ft)</u>	<u>Total Alkanes</u>	<u>Total Alkenes</u>	<u>Total VOCs</u>
W23	730.20-720.00	nd	3000	3000
W21	728.00-717.80	24	50	74
W20R	726.80-716.60	16	9	25
W3R	725.10-714.90	7	5	12
G104	722.18-717.17	39	6	45
G109	723.64-718.67	8	nd	8
G110	721.20-716.20	nd	4	4
W19	725.00-714.80	2	nd	2
W23B	709.10-703.90	367	1003	1370
W21B	692.90-687.70	25	2	27
W20B	697.40-692.20	8	11	19
W5R	691.50-686.30	52	18	70
W25C	676.50-671.30	10	1	11

A general decrease in concentration as distance from the BCP increases can be observed. Disparities in this trend, observed for G104 and W5R, may be temporal in nature, or due to variation in the aquifer matrix. Further investigation into this pattern may further clarify contaminant transport in this area. This decrease is likely due to a combination of the mechanisms discussed in Section 7.1.

Due to the irregular areal distribution of VOC detections in the Blackhawk Acres subdivision and due to the lack of VOC detections in water quality boring DB2, and well nests W13 and W14, and W22C, it may not be possible to identify a known source or migration pathway for the occurrence of these VOCs. Further evaluation of the Blackhawk Acres Subdivision, Soterion, and Beloit Corporation's BCP, FSDA, and SYA may be necessary to identify potential sources and migration pathways for the VOCs detected in the subdivision.

7.2.2 Semivolatiles

SVOCs detected at the site include phenols, phthalates, and polynuclear aromatic hydrocarbons (PAHs).

Phenols detected include phenol, 2- and 4-methylphenol (o- and p-cresol), and 2,4-dimethylphenol. These compounds were only detected at SB12, in the FSDA. These compounds are considered relatively mobile. Phenols undergo biodegradation in the soil. These compounds were not detected in groundwater samples from well nest W21 located south of SB12.

4-Nitrophenol was detected in surface soil samples from SB11 in the former FSSA, and SB21 at the BCP. This compound is emitted in vehicular exhaust from gasoline and diesel engines, and is a degradation product of parathion. Although 4-nitrophenol would not be expected to adsorb appreciably to soils, it will rapidly biodegrade in the soil. 4-Nitrophenol was also detected in background sample SG107.

PAHs were detected in soils from the FSDA, Soterion, BCP, and Rockton Excavating. PAHs are products of the incomplete combustion of organic materials, including petroleum products and asphalt, coal, and wood. Asphalt particles in a sample may result in significant PAH concentrations. It may be difficult to identify site related concentrations from ubiquitous anthropogenic sources when concentrations are low. As a group, these compounds have high specific gravity, are very slightly soluble in water, low Henry's Law constants, and have low vapor pressures. These compounds were not detected in any monitoring wells.

Phthalates were in detected soil samples from the site. These compounds, used as plasticizers, are widely present in the environment. They are expected to be adsorbed to the soil, where they slowly biodegrade.

7.2.3 Pesticides/PCBs

Pesticides detected in samples from the site include heptachlor, DDT, methoxychlor, and the endrin breakdown products endrin aldehyde and endrin ketone. PCBs detected were identified as aroclor -1248, -1254, and -1260.

Heptachlor and DDT were detected together in soil samples from the former FSSA, the FSDA, and BCP, at depths of 16 to 34 feet. Both are expected to be strongly adsorbed to the soil, and moderately persistent. DDT and Heptachlor have been strictly regulated in the U.S. since 1973 and 1983, respectively.

Methoxychlor was detected in soil boring SB12, located in the FSDA. This insecticide, used on a wide array of crops, is expected to have limited mobility, and not leach into groundwater. The environmental fate of methoxychlor is primarily biodegradation under anaerobic conditions.

Endrin, a persistent insecticide, avicide, and rodenticide, has been severely restricted in the U.S. Endrin may persist in the soil for very long periods of time, and is strongly adsorbed to the soil. Groundwater concentration may be due to suspended particles. The breakdown products of endrin were detected in samples from the site. Endrin ketone was detected in SB12.

PCBs were detected in surface soil samples from the FSDA, BCP, wastewater treatment ponds, and gravel pit. PCBs are highly persistent, and are strongly absorbed to soil. PCBs were not detected in the groundwater samples.

7.2.4 Metals

Inorganic (metals) data is summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (i.e., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Determination of metals present above background, and thus requiring evaluation of possible fate and transport mechanisms, cannot be performed for this Technical Memorandum due to the insufficient number of background soil samples.

Cyanide was detected in two groundwater monitoring wells (W18 and W26C). Cyanide was not found in any of the soil samples. Cyanide exists in water as HCN, a weak acid. CN^- has a strong affinity for many metal ions, in particular iron(II), forming stable iron complexes. Iron was detected in the field duplicate for W18. This affinity to form metal complexes is pH dependent, and favors a high pH. Biological degradation of cyanide complexes may occur in aqueous environments. Cyanide was not detected downgradient at G108D.

[mad-606-198g]

SUMMARY OF FINDINGS

This section summarizes the findings of Phase 1 of the Beloit Corporation RI/FS.

8.1 SURFACE GEOPHYSICAL SURVEY

Rockton Excavating: An EM and MAG survey were conducted over the parking area between the building and Watts Avenue and a spot-check (a spot check was only possible due to the large quantity of metal, wood and concrete debris) with the EM device was performed behind the building located on-site. The survey over the front half of the property discovered a large buried metal object in close proximity to Watts Avenue, which may be associated with some type of utility, city water, or sewer. The spot-check over the back half of the property was able to identify large areas of unidentifiable buried metal behind the building.

Soterion: The property did not lend itself to a MAG survey due to the large metal buildings on the property, therefore, only an EM survey was conducted. This survey discovered two buried metal objects, one approximately 5 ft by 10 ft in size and the other approximately 5 ft by 20 ft in size. These could be buried underground storage tanks.

8.2 TOPOGRAPHY AND GEOLOGY

The relatively flat surface topography is blanketed with 1 to 4 ft of clayey, sandy silt soils, except where they have been removed. Ground surface slopes gently towards the Rock River to the south and west from the gravel pit in the northeast corner of Beloit Corporation's property. A well organized surface drainage system does not exist. Sheet flow is the primary method for surface drainage at this site.

The site is located over the ancestral Pecatonica/Sugar Bedrock valley where it merges with the Rock Bedrock valley. In general, the upper 25 to 35 feet of soils are composed of coarse glacial outwash sands and gravels which appear to extend laterally over the entire site. Underlying this coarse outwash deposit is an approximately 65 ft thick outwash deposit consisting of an upper (35 ft thick) fine grained glacial outwash sand and silty sand deposit which is interbedded with a lower (30 ft thick) coarse glacial outwash sand and gravel deposit. The upper fine grained outwash deposit appears to extend laterally over the entire southern half of the site. It is thickest in the southeast portion of the site, thins to the west and actually pinches out to the north and northwest where the lower coarse deposit comes into contact with the upper coarse outwash deposit. The lower coarse outwash deposit extends laterally over the southern half of Beloit Corporation's property. It appears to terminate along Beloit Corporation's eastern property line. These outwash deposits are bounded below by an approximately 5 to 20 ft thick lacustrine clay deposit which appears to extend laterally over the entire site.

8.3 HYDROGEOLOGY

There appear to be several factors controlling groundwater flow beneath this site.

- Recharging of the groundwater system by the Rock River along the southwest and western portions of the site is instrumental in formation of the "groundwater trough".
- Recharge into the gravel pit area is responsible for the formation of the groundwater divide.
- The low permeability zone (hydraulic conductivities ranging from 10^{-6} to 10^{-3}) is contained within the fine grained upper outwash aquifer. Groundwater may try to seek the path of least resistance in the clean sand, and sand and gravel units that extend under and around this low permeability unit.

In general, groundwater flows to the west, southwest, south, southeast, and east from the groundwater divide and then flows southwest, south and southeast as it moves away from the divide.

8.4 CONTAMINANT NATURE AND EXTENT

Chemicals of potential concern detected at the site consist primarily of VOCs present in the groundwater, at both monitoring and private well locations. These

VOCs consist of chlorinated alkanes and alkenes, with lesser amounts of aromatics, ketones, and other compounds. Chlorinated VOCs were found at the highest concentration levels in groundwater monitoring wells located at well nest W23/W23B, adjacent to the southwest corner of the BCP. Ketones were found in soil boring samples from SB08, located at the Soterion Area. The ketone acetone was also found in one surface soil sample each from the FSDA, the SYA, and one background location. Aromatics were primarily found in soil boring samples from the Soterion area and from the BCP. Other compounds detected include chloroform, carbon disulfide, and 1,4-dichlorobenzene. Carbon disulfide was detected in one groundwater sample (W22B) and 1,4-dichlorobenzene in one private well (900 N. Prairie). Chloroform was found in eight private well samples from the Blackhawk Acres Subdivision.

The Maximum Contaminant Level (MCL) for tetrachlorethene was exceeded at groundwater monitoring wells W3R, W21, W23, W5R, W20B and W23B. The MCL for trichloroethene was exceeded at groundwater monitoring wells W21, W23B, W18, and W26C. The MCL for 1,2-dichloroethane was exceeded at groundwater monitoring well W23B.

SVOCs, primarily PAHs, with smaller concentrations of phenolics and phthalates, were also detected in soil samples, primarily in samples from the FSDA, Rockton Excavating, and the BCP areas. These compounds were not detected in the groundwater.

Pesticides detected in soil include heptachlor, DDT, endrin ketone, and methoxychlor. Heptachlor and DDT were only detected at depth, primarily in soil. Both of these compounds are strongly adsorbed to soil materials. Endrin ketone and methoxychlor were found in a single soil boring from the FSDA. PCBs were reported at low concentrations in four surface soil samples from three site areas. These compounds were not detected in groundwater.

Inorganic (metals) data for soil samples are summarized in Table 6-6. Metals present in soils may be anthropogenic in origin (e.i., due to either site related or other, non-site related anthropogenic activities), or natural (background) concentrations. Evaluation of metals data cannot be performed for this Technical Memorandum due to the insufficient number of background soil samples, but will be included in the final RI report.

Metals analysis of groundwater samples from monitoring wells screened at shallow depths indicates background values were exceeded in at least one sample for arsenic, barium, cadmium, copper, iron, magnesium, manganese, nickel, and silver. Well W15 results varied by more than an order of magnitude for a number

of parameters, including aluminum, calcium, potassium, sodium, and zinc, as well as the indicator parameters chloride, total dissolved solids, and conductivity.

Metals analysis of groundwater samples from monitoring wells screened at intermediate depths indicated background values were exceeded in at least one sample for cadmium, chromium, iron, lead, manganese, nickel, and zinc.

Metals analysis of groundwater samples from monitoring wells screened at deep depths indicated background values were exceeded in at least one sample for iron and cyanide. Cyanide was detected at W18 and W26C.

The MCL for cadmium was exceeded at groundwater monitoring wells W3R, W20B, and W24. The MCL for nickel was exceeded at groundwater monitoring wells W14 and W15.

Groundwater has been identified as the primary migration pathway for contaminant transport at this site. A potential source area has been identified at the southwest corner of the BCP in the vicinity of well nest W23. Groundwater data indicate a VOC plume emanating from well nest W23. It extends to the south paralleling the "groundwater trough" where it is detected at its most distal point in well W19.

The source(s) and migration pathway(s) for the chlorinated VOCs and chloroform detected in the Blackhawk Acres Subdivision has (have) not been identified.

In addition, Soterion appears to be a source of aromatic VOC and metal contamination. Aromatic VOCs were not detected in the downgradient groundwater monitoring well or the upgradient private wells in Blackhawk Acres Subdivision, but chromium was detected in IEPA well G108D.

8.5 DATA DEFICIENCIES

Based on the results of Phase 1, further definition of potential source(s), and migration pathways should be considered. At a minimum, additional evaluation should include determining the depth of screened intervals in affected private water supply wells, and collection of a second round of groundwater quality data from a mutually agreeable select number of monitoring wells and private wells. These groundwater quality samples are to be analyzed for a mutually agreeable set of TCL parameters.

[mad-606-198h]

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JAH/JEM/vlr/SBH/KJD/RJK/KJQ/DWH
[mad-606-198i]
1526892/28238

TABLE 4-1**Field PID Soil Gas Detects Above Background****Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study**

SAMPLE LOCATION	PID READING
SG 51	1.3 ppm
SG 191	1.5 ppm
SG 301	12 ppm
SG 32	23.5 ppm
SG 361	2.5 ppm
SG 371	2 ppm
SG 451	0 ppm
SG 481	0.7 ppm
SG 57	120 ppm
SG 57 Dup	100 ppm
SG 63	4.4 ppm
SG 641	1.3 ppm
SG 78	3.3 ppm
SG 961	2 ppm
SG 107	8.5 ppm
SG 108	0.7 ppm
SG 125	1.5 ppm
SG 126	4 ppm
SG 127	2.5 ppm
SG 130	7.5 ppm
SG 130 Dup	8 ppm
SG 131	6 ppm

NOTES:

- (1) These samples showed no detection of target compounds after field GC analysis.

TJD/JV/RJR/JEM
[C\PIDGAS]

TABLE 4-2
Monitoring Well Construction Summary
(1983 - 1992)

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

Well No.	Well Material	Date Installed	Drilled By	Top of Casing Elevation (Feet)	Ground Elevation (Feet)	Well Depth	Screen Interval (Depth-ft.)	Screen Interval (Elev.-ft)	Lower Seal Interval (Depth-ft.)	Lower Seal Interval (Elev.-ft.)
W01*	2" PVC	10/27/83	Warzyn	749.53	746.90	37.00	27.00 - 37.00	719.90 - 709.90	0.00 - 4.00	746.90 - 742.90
W02*	2" PVC	10/26/83	Warzyn	754.94	752.90	37.00	27.00 - 37.00	725.90 - 715.90	0.00 - 4.00	752.90 - 748.90
W03R	2" PVC/304SS	7/27/92	Layne NW	746.22	744.00	29.50	18.90 - 29.10	725.10 - 714.90	0.50 - 16.80	743.50 - 727.20
W04*	2" PVC	4/24/84	ETI	754.52	752.70	38.00	28.00 - 38.00	724.70 - 714.70	0.00 - 4.00	752.70 - 748.70
W05R	2" PVC/304SS	8/3/92	Layne NW	746.43	744.00	58.00	52.50 - 57.70	691.50 - 686.30	45.00 - 51.00	699.00 - 693.00
W06*	2" PVC	4/20/84	ETI	747.61	745.20	38.40	28.40 - 38.40	716.80 - 706.80	0.00 - 4.00	745.20 - 741.20
W07*	2" PVC	4/18/84	ETI	751.20	749.10	33.40	23.40 - 33.40	725.70 - 715.70	0.00 - 4.00	749.10 - 745.10
W08R	2" PVC/304SS	8/18/92	Layne NW	774.83	771.90	52.00	41.40 - 51.60	730.50 - 720.30	3.00 - 39.50	768.90 - 732.40
W09*	2" PVC	4/19/84	ETI	754.62	752.70	34.50	24.50 - 34.50	728.20 - 718.20	0.00 - 4.00	752.70 - 748.70
W10*	2" PVC	4/19/84	ETI	754.61	752.60	57.70	52.70 - 57.70	699.90 - 694.90	48.00 - 51.00	704.60 - 701.60
W11R	2" PVC/304SS	8/17/92	Layne NW	771.82	771.90	61.10	55.90 - 61.10	716.00 - 710.80	2.10 - 53.50	769.80 - 718.40
W12*	2" 304SS	6/4/87	ETI	757.15	754.80	32.90	23.60 - 32.90	731.20 - 721.90	0.00 - 19.00	754.80 - 735.80
W13*	2" 304SS	6/1/87	ETI	755.20	753.10	30.00	20.00 - 30.00	733.10 - 723.10	0.00 - 16.00	753.10 - 737.10
W14*	2" 304SS	6/5/87	ETI	753.75	752.60	58.40	53.80 - 58.40	698.80 - 694.20	0.00 - 48.00	752.60 - 704.60
W15*	2" 304SS	6/9/87	ETI	753.32	751.00	30.50	20.50 - 30.50	730.50 - 720.50	0.00 - 17.50	751.00 - 733.50
W16R	2" PVC/304SS	8/19/92	Layne NW	761.54	758.80	41.50	29.60 - 39.80	729.20 - 719.00	2.80 - 27.20	756.00 - 731.60
W17*	2" 304SS	6/8/87	ETI	735.36	732.80	15.50	5.50 - 15.50	727.30 - 717.30	0.00 - 3.00	732.80 - 729.80
W18*	2" 304SS	2/13/89	EFD	748.35	746.10	85.00	67.00 - 72.00	679.10 - 674.10	64.00 - 67.00	682.10 - 679.10
W19	2" PVC/304SS	7/31/92	Layne NW	744.76	742.10	28.00	17.10 - 27.30	725.00 - 714.80	1.00 - 15.30	741.10 - 726.80
W19B	2" PVC/304SS	7/31/92	Layne NW	744.97	742.10	58.50	51.90 - 57.10	690.20 - 685.00	45.50 - 50.50	696.60 - 691.60
W20R	2" PVC/304SS	7/21/92	Layne NW	746.58	743.90	28.50	17.10 - 27.30	726.80 - 716.60	0.50 - 16.00	743.40 - 727.90
W20B	2" PVC/304SS	7/29/92	Layne NW	747.11	743.90	58.50	46.50 - 51.70	697.40 - 692.20	40.50 - 45.40	703.40 - 698.50
W21	2" PVC/304SS	7/20/92	Layne NW	750.29	747.80	30.00	19.80 - 30.00	728.00 - 717.80	0.50 - 18.00	747.30 - 729.80
W21B	2" PVC/304SS	8/4/92	Layne NW	750.39	747.80	60.30	54.90 - 60.10	692.90 - 687.70	47.50 - 53.00	700.30 - 694.80
W22	2" PVC/304SS	7/20/92	Layne NW	757.93	754.90	41.00	24.30 - 34.50	730.60 - 720.40	0.50 - 22.50	754.40 - 732.40
W22B	2" PVC/304SS	8/7/92	Layne NW	758.13	754.90	61.00	55.00 - 60.20	699.90 - 694.70	5.00 - 53.00	749.90 - 701.90
W22C	2" PVC/304SS	7/7/92	Layne NW	757.71	754.90	105.00	67.90 - 73.10	687.00 - 681.80	3.00 - 65.00	751.90 - 689.90
W23	2" PVC/304SS	7/27/92	Layne NW	753.59	753.90	35.00	23.70 - 33.90	730.20 - 720.00	1.50 - 21.00	752.40 - 732.90
W23B	2" PVC/304SS	8/5/92	Layne NW	753.38	753.70	79.00	44.60 - 49.80	709.10 - 703.90	3.00 - 42.70	750.70 - 711.00
W24	2" PVC/304SS	8/20/92	Layne NW	755.44	752.30	40.00	21.90 - 32.10	730.40 - 720.20	2.00 - 19.50	750.30 - 732.80

TABLE 4-2 (Continued)

Well No.	Well Material	Date Installed	Drilled By	Top of Casing Elevation (Feet)	Ground Elevation (Feet)	Well Depth	Screen Interval (Depth-ft.)	Screen Interval (Elev.-ft)	Lower Seal Interval (Depth-ft.)	Lower Seal Interval (Elev.-ft.)
W25C	2" PVC/304SS	8/17/92	Layne NW	746.72	744.20	80.00	67.70 - 72.90	676.50 - 671.30	3.00 - 64.80	741.20 - 679.40
W26C	2" PVC/304SS	7/28/92	Layne NW	754.55	751.90	109.50	71.80 - 77.00	680.10 - 674.90	62.00 - 69.40	689.90 - 682.50
W27	2" PVC/304SS	8/18/92	Layne NW	767.22	764.80	51.00	40.20 - 50.40	724.60 - 714.40	3.00 - 38.60	761.80 - 726.20
W28	2" PVC/304SS	8/18/92	Layne NW	752.27	752.80	37.50	22.20 - 32.40	730.60 - 720.40	2.00 - 20.10	750.80 - 732.70
W29	2" PVC/304SS	8/20/92	Layne NW	749.87	747.60	31.00	20.40 - 30.60	727.20 - 717.00	1.00 - 18.00	746.60 - 729.60
G101*	2" PVC	5/15/84	IEPA	766.37	763.70	53.00	37.30 - 52.30	726.40 - 711.40	12.40 - 16.40	751.30 - 747.30
G103S*	2" 316SS	5/15/84	IEPA	748.87	746.40	25.80	20.30 - 25.30	726.10 - 721.10	0.00 - 10.00	746.40 - 736.40
G103D*	2" 316SS	6/26/86	IEPA	747.89	746.10	49.00	43.60 - 49.00	702.50 - 697.10	0.00 - 30.00	746.10 - 716.10
G104*	2" 316SS	5/21/86	IEPA	744.56	741.73	25.03	19.55 - 24.56	722.18 - 717.17	0.00 - 10.00	741.73 - 731.73
G107*	2" 316SS	7/16/86	IEPA	771.24	769.34	48.70	43.24 - 48.23	726.10 - 721.11	0.00 - 6.80	769.34 - 762.54
G108S*	2" 316SS	3/4/87	IEPA	756.91	754.05	39.77	34.33 - 39.31	719.72 - 714.74	0.00 - 9.00	754.05 - 745.05
G108D*	2" 316SS	3/4/87	IEPA	756.36	753.84	72.00	66.20 - 71.11	687.64 - 682.73	0.00 - 15.00	753.84 - 738.84
G109*	2" 316SS	3/11/87	IEPA	738.99	735.59	18.00	11.95 - 16.92	723.64 - 718.67	0.00 - 6.30	735.59 - 729.29
G110*	2" 316SS	3/11/87	IEPA	738.20	735.57	20.00	14.37 - 19.37	721.20 - 716.20	0.00 - 6.00	735.57 - 729.57

Notes:

- 1) ETI - Exploration Technology Inc.
- 2) EFD - Environmental and Foundation Drilling
- 3) - - - Information not available at this time.
- 4) Unable to locate IEPA Monitoring Wells G102, G105, and G106. It is assumed that they were inadvertently destroyed.
- 5) * - Existing Monitoring Well

JEM/jlv/MCB
[Beloit/Table4-2]

TABLE 4-3
Address of Properties in Blackhawk Acres Subdivision

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

PLAT BOOK PAGE REFERENCE	SAMPLE DESIGNATION	PLAT BOOK PROPERTY CODE	PROPERTY OWNER ADDRESS	PROPERTY STREET NAME	PROPERTY STREET NUMBER	ADDITIONAL PROPERTIES (PLAT BOOK PROPERTY CODE) (1), (2)	COMMENTS
P-49A		001	750 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	BLACKHAWK BLVD	826	(055), (094A)	826 - no residence, just land
P-49A		002	409 DINGMAN, ROCKTON, IL., 61072	DINGMAN	409		
P-49A		003	407 DINGMAN, ROCKTON, IL., 61072	DINGMAN	407		Connected to city water
P-49A		004	7042 ROCKTON RD., ROSCOE, IL., 61073	BLACKHAWK BLVD	906		Connected to city water
P-49A	PW03	005	909 WATTS AVE., ROCKTON, IL., 61072	BLACKHAWK BLVD	908	052	
P-49A	PW48	006	916 BLACKHAWK BLVD., ROCKTON, IL., 61072	BLACKHAWK BLVD	916		
P-49A		07A	918 BLACKHAWK BLVD, BOX 228, ROCKTON, IL., 61072	BLACKHAWK BLVD	918		
P-49A	PW22	011	1016 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1016		
P-49A	PW50	012	1102 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1102		
P-49A	PW23	013	1106 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1106	(044)	
P-49A	PW36	014	1110 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1110		
P-49A	PW35	015(016)	1114 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1114		
P-49A	PW15	017	1204 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1204		
P-49A	PW20	018	1208 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1208		
P-49A	PW25	019	1212 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1212		
P-49A	PW19	020	1220 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1220		
P-49A	PW09	021	1302 N. BLACKHAWK BLVD. ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1302	(038)	
P-49A	PW11	022	1310 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1310	(023A), (038)	
P-49A	PW13	024	1314 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1314	(034)	
P-49A	PW06	025	1404 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1404	(033)	
P-49A		026	1406 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1406		
P-49A	PW46	026	1406 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1406		
P-49A	PW44	027	1412 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1412		
P-49A	PW27	028	1416 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1416	(030), (031)	
P-49A	PW38	029	3055 FREEPORT RD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1502		
P-49A		032	1404 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	NO ADDRESS-LAND			
P-49A		034	1314 N. BLACKHAWK BLVD., ROCKTON, IL., 61072	N. BLACKHAWK BLVD	1314		
P-49A	PW52	037	1301 WATTS, ROCKTON, IL., 61072	WATTS	1301		
P-49A	PW39	039A	P.O. BOX 242, ROCKTON, IL., 61072	WATTS	1215		
P-49A	PW29	039B	416 KILE DR., ROCKTON, IL., 61072	KILE DR.	416		
P-49A	PW05	040	1207 WATTS, ROCKTON, IL., 61072	WATTS	1207		
P-49A		040B	6803 SHIRLAND RD., ROCKTON, IL., 61072	NO ADDRESS - LAND			
P-49A	PW34	041	15290 S. BLUFF RD., SOUTH BELOIT, IL., 61080	WATTS	1117		Rental property
P-49A	PW14	042	1113 WATTS, ROCKTON, IL., 61072	WATTS	1113	(043)	
P-49A	PW51	045	407 CENTRAL, ROCKTON, IL., 61072	CENTRAL	407		
P-49A	PW30	046	P.O. BOX 259, ROCKTON, IL., 61072	WATTS	1011		
P-49A	PW08	047	1009 WATTS, ROCKTON, IL., 61072	WATTS	1009		
P-49A	PW40	048	1007 WATTS, ROCKTON, IL., 61072	WATTS	1007		
P-49A	PW47	049	1005 WATTS, ROCKTON, IL., 61072	WATTS	1005		
P-49A	PW24	050	917 WATTS, ROCKTON, IL., 61072	WATTS	917		
P-49A	PW10	051	913 WATTS, ROCKTON, IL., 61072	WATTS	913		

TABLE 4-3 (Continued)

PLAT BOOK PAGE REFERENCE	SAMPLE DESIGNATION		PROPERTY OWNER ADDRESS	PROPERTY STREET NAME	PROPERTY STREET NUMBER	ADDITIONAL PROPERTIES (PLAT BOOK PROPERTY CODE) (1), (2)	COMMENTS
P-49A	PW01	052	908 BLACKHAWK & 909 WATTS, ROCKTON, IL., 61072	WATTS	909	005	908 is rental property
P-49A	PW12	053	905 WATTS, ROCKTON, IL., 61072	WATTS	905		
P-49A	PW28	054	403 DINGMAN, ROCKTON, IL., 61072	DINGMAN	403		
P-49A		056A	1643 YALE BRIDGE RD., SOUTH BELOIT, IL., 61080	NO ADDRESS - LAND		(095A), (056C), (079)	(See 800 & 1314 Watts)
P-49A		056B	2648 RIVERSIDE DR., BELOIT, WI., 53511	WATTS	900		Storage-no residence
P-49A	PW04	057	P.O. BOX 28, SHIRLAND, IL., 61079	WATTS	910		
P-49A		058	11339 SHADYWOOD, BRIGHTON, MI., 48116	NO ADDRESS - LAND			
P-49A	PW02	058A	914 WATTS, ROCKTON, IL., 61072	WATTS	914		
P-49A		059	918 WATTS, ROCKTON, IL., 61072	WATTS	918		
P-49A	PW07	060	1004 WATTS, ROCKTON, IL., 61072	WATTS	1004		
P-49A		061	16449 SHARP RD., ROCKTON, IL., 61072	NO ADDRESS - LAND			
P-49A	PW31	062	1012 WATTS, ROCKTON, IL., 61072	WATTS	1012		
P-49A		063	1000 WATTS, ROCKTON, IL., 61072	WATTS	1000		
P-49A	PW49	064	1020 WATTS, ROCKTON, IL., 61072	WATTS	1020		
P-49A	PW41	065	1102 WATTS, ROCKTON, IL., 61072	WATTS	1102		
P-49A	PW42	066	1104 WATTS, ROCKTON, IL., 61072	WATTS	1104		
P-49A		067	1114 WATTS AVE., ROCKTON, IL., 61072	WATTS	1112		
P-49A	PW55	068	1114 WATTS, ROCKTON, IL., 61072	WATTS	1114		
P-49A		071A	1200 WATTS, ROCKTON, IL., 61072	WATTS	1200		
P-49A	PW26	071C	1140 WATTS, ROCKTON, IL., 61072	WATTS	1140		
P-49A	PW45	072	1212 WATTS, ROCKTON, IL., 61072	WATTS	1212		
P-49A	PW16	073	1216 WATTS, ROCKTON, IL., 61072	WATTS	1216		
P-49A		074	1220 WATTS, ROCKTON, IL., 61072	WATTS	1220		New Owner
P-49A	PW32	075	1304 WATTS, ROCKTON, IL., 61072	WATTS	1304	076	1300 On Same Lot
P-49A	PW43	076	1304 WATTS, ROCKTON, IL., 61072	WATTS	1308	075	
P-49A	PW18	077	1310 WATTS, ROCKTON, IL., 61072	WATTS	1310		
P-49A		078	110 SOUTH BLUFF, SOUTH BELOIT, IL., 61080	NO ADDRESS - LAND			
P-49A	PW17	079	1314 WATTS (See LaVerne Collins)	WATTS	1314	56A, 95A, 56C, DB3	
P-49A				WATTS	800		
P-49A							
P-49A	PW33	080B	1404 WATTS AVE., ROCKTON, IL., 61072	WATTS	1404		
P-49A		080C	1402 WATTS, ROCKTON, IL., 61072	WATTS	1402		
P-49A	PW37	10A	1012 N. BLACKHAWK BLVD., ROCKTON, IL., 60172	N. BLACKHAWK BLVD.	1012		New Owner
P-49A	PW21	020A	410 KILE DR., ROCKTON, IL., 61072	KILE DR.	410		
P-49A	PW53		900 NORTH PRAIRIE, ROCKTON, IL., 61072	N. PRAIRIE	900		Do not contact per K. Domack
P-49A	PW54		903 NORTH PRAIRIE, ROCKTON, IL., 61072	N. PRAIRIE	903		

NOTES:

PROPERTY CODES UNDER "ADDITIONAL PROPERTIES" ENCLOSED IN PARENS = LAND ONLY.
 RTY CODES UNDER "ADDITIONAL PROPERTIES" NOT ENCLOSED IN PARENS = ADDITIONAL RESIDENCE.
 HOME NUMBER SECTION ADDED AFTER INITIAL TELEPHONE CONTACT FOR TESTING OF TAP WATER

TABLE 5-1
Summary of Calculated In-Situ Hydraulic Conductivities

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

WELL I.D.	METHOD	HYDRAULIC CONDUCTIVITY (cm/sec)	AQUIFER SOIL DESCRIPTION
G103S	bailer	9.60E-06	silty sand with gravel
G103D	bailer	4.56E-05	sandy clay
W3R	bailer	9.08E-03	sand
W5R	bailer	1.28E-02	sand
W8R	bailer	2.30E-03	coarse gravel & coarse sand w/ silt & clay
W11R	bailer	1.00E-03	sand with silt and clay
W13	bailer	8.70E-05	silty sand
W14	bailer	1.80E-02	silty sand
W18	bailer	2.30E-02	sand
W19	bailer	2.97E-02	sand
W19B	bailer	1.00E-02	sand
W20R	bailer	1.21E-02	sand
W20B	bailer	1.12E-02	sand
W21	bailer	1.32E-02	sand
W21B	bailer	2.30E-02	sand & gravel
W22	bailer	2.00E-03	silt
W22B	air pressure	1.10E-02	gravel
W22C	air pressure	1.30E-03	gravel
W23	bailer	6.86E-03	silty sand
W23B	bailer	1.01E-04	sand & gravel
W24	bailer	1.87E-03	gravel
W25C	bailer	1.50E-02	silty sand
W26C	air pressure	3.61E-04	silty, clayey, sandy, gravel
W27	bailer	3.20E-04	sand and gravel
W28	bailer	4.75E-04	silty, clayey, sand and gravel
W29	bailer	3.03E-03	sand

NOTES:

- 1) In-Situ Hydraulic Conductivity Testing was conducted by Warzyn Inc. during August, 1992.
- 2) Appendix J contains the raw baildown data and identifies the method used to calculate K.
- 3) Refer to section 4.14 for a detail description of field methods.

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[C\BCHYDR2]

TABLE 5-2

Summary of Calculated Horizontal Flow
 Beloit Corporation - Blackhawk Facility
 Remedial Investigation/Feasibility Study

SOIL TYPES	K GEOMETRIC MEAN (CM/SEC)	HORIZONTAL FLOW (FT/YR)
GRADIENT OF .003		
POROSITY OF .25		
SILTY SAND AND GRAVEL	9.60E-06	0.1
SANDY CLAY	4.56E-05	0.6
SAND	1.18E-02	145.9
COARSE GRAVEL & SAND W/SILT & CLAY	2.30E-03	28.5
SAND W/SILT AND CLAY	1.00E-03	12.4
SILTY SAND	3.56E-03	44.2
SAND & GRAVEL	9.06E-04	11.2
SILT	2.00E-03	24.8
GRAVEL	2.99E-03	37.1
SILTY, CLAYEY, SANDY GRAVEL	3.61E-04	4.5
SILTY, CLAYEY SAND & GRAVEL	4.75E-04	5.9
GRADIENT OF .003		
POROSITY OF .30		
SILTY SAND AND GRAVEL	9.60E-06	0.1
SANDY CLAY	4.56E-05	0.5
SAND	1.18E-02	121.6
COARSE GRAVEL & SAND W/SILT & CLAY	2.30E-03	23.8
SAND W/SILT AND CLAY	1.00E-03	10.3
SILTY SAND	3.56E-03	36.8
SAND & GRAVEL	9.06E-04	9.4
SILT	2.00E-03	20.7
GRAVEL	2.99E-03	30.9
SILTY, CLAYEY, SANDY GRAVEL	3.61E-04	3.7
SILTY, CLAYEY SAND & GRAVEL	4.75E-04	4.9
GRADIENT OF .003		
POROSITY OF .35		
SILTY SAND AND GRAVEL	9.60E-06	0.1
SANDY CLAY	4.56E-05	0.4
SAND	1.18E-02	104.2
COARSE GRAVEL & SAND W/SILT & CLAY	2.30E-03	20.4
SAND W/SILT AND CLAY	1.00E-03	8.9
SILTY SAND	3.56E-03	31.6
SAND & GRAVEL	9.06E-04	8.0
SILT	2.00E-03	17.7

TABLE 5-2

Summary of Calculated Horizontal Flow
Beloit Corporation - Blackhawk Facility
Remedial Investigation/Feasibility Study

GRAVEL	2.99E-03	26.5
SILTY, CLAYEY, SANDY GRAVEL	3.61E-04	3.2
SILTY , CLAYEY SAND & GRAVEL	4.75E-04	4.2
JEM/ ITAPE		
HORZFLOW.XLS		

TABLE 5-3
Water Level Summary
Beloit Corporation - Blackhawk Facility
Remedial Investigations / Feasibility Study

Well ID	Elevation Top of PVC (ft)	Elevation Ground Surface (ft)	P = Piezometer W = Water Table	Depth To SWL (8-25-92) (ft)	Elevation SWL (8-25-92) (ft)	Depth To SWL (9-21-92) (ft)	Elevation SWL (9-21-92) (ft)	Depth To SWL (11-12-92) (ft)	Elevation SWL (14-12-92) (ft)
G101	766.37	763.70	W	44.52	721.85	44.57	721.80	44.71	721.66
G103D	747.89	746.09	P	24.24	723.65	24.21	723.68	24.41	723.48
G103S	748.87	746.37	W	25.14	723.73	25.17	723.70	25.33	723.54
G104	744.56	741.73	W	22.16	722.4	21.97	722.59	22.12	722.44
G107	771.24	769.34	W	43.24	728	43.18	728.06	43.4	727.84
G108D	756.36	753.84	P	36.77	719.59	36.66	719.70	36.9	719.46
G108S	756.91	754.05	W	37.36	719.55	37.26	719.65	37.59	719.32
G109	738.99	735.59	W	16.94	722.05	16.56	722.43	16.78	722.21
G110	738.20	735.57	W	16.78	721.42	16.23	721.97	16.54	721.66
P01	734.52	733.30	P	12.15	722.37	11.68	722.84	11.88	722.64
W01	749.64	747.00	W	22.79	726.85	22.41	727.23	22.67	726.97
W10	754.73	752.80	P	27.27	727.46	26.87	727.86	27.32	727.41
W11R	774.82	771.90	P	46.47	728.35	46.46	728.36	46.71	728.11
W12	757.38	754.70	W	34.27	723.11	34.41	722.97	34.55	722.83
W13	755.37	752.90	W	28.78	726.59	27.68	727.69	28.78	726.59
W14	753.93	752.70	P	27.57	726.36	27.05	726.88	27.68	726.25
W15	753.38	751.20	W	24.82	728.56	24.60	728.78	24.96	728.42
W16R	761.54	758.80	W	33.41	728.13	33.32	728.22	33.63	727.91
W17	735.55	733.00	W	10.49	725.06	9.22	726.33	7.59	727.96
W18	748.35	746.10	P	25.46	722.89	25.28	723.07	25.61	722.74
W19	744.76	742.10	W	23.68	721.08	23.30	721.46	23.54	721.22
W19B	744.97	742.10	P	23.65	721.32	23.27	721.70	23.51	721.46
W02	755.05	752.90	W	30.87	724.18	30.83	724.22	31.05	724.00
W20B	747.11	743.90	P	23.93	723.18	23.69	723.42	23.82	723.29
W20R	746.58	743.90	W	23.35	723.23	23.21	723.37	23.3	723.28
W21	750.29	747.80	W	26.31	723.98	26.19	724.10	26.31	723.98
W21B	750.39	747.80	P	26.48	723.91	26.22	724.17	26.34	724.05
W22	757.93	754.90	W	33.54	724.39	33.52	724.41	33.62	724.31
W22B	758.13	754.90	P	33.93	724.2	33.85	724.28	34.08	724.07
W22C	757.71	754.90	P	33.87	723.84	33.85	723.86	34.06	723.65
W23	753.59	753.90	W	26.21	727.38	25.60	727.99	26.15	727.44
W23B	753.38	753.70	P	27.93	725.45	25.90	727.48	26.28	727.10
W24	755.44	752.30	W	27.46	727.98	27.25	728.19	27.61	727.83
W25C	746.72	744.20	P	24.36	722.36	24.15	722.57	24.31	722.41
W26C	754.55	751.80	P	33.14	721.41	32.92	721.63	33.18	721.37
W27	767.22	764.80	W	40.56	726.66	40.25	726.97	40.8	726.42
W28	752.27	752.83	W	23.94	728.33	22.88	729.39	23.33	728.94
W29	749.87	747.60	W	29.18	720.69	28.92	720.95	29.51	720.36
W03R	746.22	744.00	W	23.71	722.51	23.63	722.59	23.76	722.46
W04	754.66	752.80	W	Dry	Dry	Dry	Dry	Dry	Dry
W05R	746.17	744.00	P	23.7	722.47	23.49	722.68	23.64	722.53
W06	748.14	745.80	W	23.03	725.11	22.08	726.06	22.1	726.04
W07	751.29	749.50	W	23.5	727.79	22.72	728.57	23.14	728.15
W08R	774.83	771.09	W	46.48	728.35	46.48	728.35	46.72	728.11
W09	754.75	752.80	W	27.3	727.45	26.90	727.85	27.36	727.39

Staff Gauge	Elevation of "ZERO" Mark on the Staff Gauge (ft) (1)	Staff Gauge Reading (8-25-92) (ft)	Elevation of Surface Water (8-25-92) (ft)	Staff Gauge Reading (9-21-92) (ft)	Elevation of Surface Water (9-21-92) (ft)	Staff Gauge Reading (11-12-92) (ft)	Elevation of Surface Water (11-12-92) (ft)
SG3	724.34	1.08	725.42	1.37	725.71	1.24	725.58
SG4	724.44	0.88	725.32	1.20	725.84	1.09	725.53
SG5	724.64	0.86	725.50	1.28	725.92	1.20	725.84

NOTES: 1) BECAUSE THE STAFF GAUGES WERE SURVEYED AT THE TOP OF THE T-POST IT WAS NECESSARY TO COMPUTE THE ELEVATION OF THE "ZERO" MARK.
THE ZERO ELEVATION WAS OBTAINED BY SUBTRACTING 2.46 FT FROM THE SURVEYED ELEVATION.
0.46 FT IS THE DISTANCE BETWEEN THE TOP OF THE T-POST AND THE 2.0 FT MARK ON THE STAFF GAUGE.
2.0 FT IS THE DISTANCE BETWEEN THE TOP OF THE 2.0 FT MARK AND THE 0.0 FT MARK ON THE STAFF GAUGE.

TABLE 5-4
Calculated Vertical Hydraulic Gradients

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

WELL NEST	VERTICAL HYDRAULIC GRADIENT	
	8/25/92	9/21/92
W13/W14	-0.01	-0.03
G103S/W18	-0.02	-0.01
W19/W19B	+0.01	+0.01
W22/W22C	-0.01	-0.01
W23/W23B	-0.09	-0.02

NOTES:

1. A positive sign (+) indicates an upward vertical hydraulic gradient.
A negative sign (-) indicates a downward vertical hydraulic gradient.
2. Calculation of vertical hydraulic gradient was determined as follows:
Hydraulic Gradient = h / l , where h is the observed difference in water elevation between the wells, and l is the distance:
 - a) between the midpoints of the well screens, where both are piezometers,
or
 - b) from the water level in a water table well to the midpoint of the piezometer screen, where one well is a water table well and the other is a piezometer.

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TABLE 5-5
Summary of Grain Size Analysis Results

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

Boring	Sample No.	Sample Depth (ft)	USCS Classification	Gravel (%)	Sand (%)	Silt & Clay (%)	Silt (%)	Clay (%)	Ratio Sand & Gravel/ Silt & Clay	Ratio Silt/Clay
DB1	01	49	SM	0	81.9	18.1			4.52	N/A
DB1	02	76	SP-SM	0	94	6			15.67	N/A
DB1	03	83	CH	0.3	2.3	97.4	27.8	69.6	0.03	0.40
DB2	01	38	CL	0.1	6.5	93.4	30.4	63	0.07	0.48
DB2	02	54	SP/GP	52	46.1	1.9			51.63	N/A
DB2	04	85	CL	0	1	99	50.7	48.3	0.01	1.05
DB3	01	55	CL	1.8	4.5	93.7	43.9	49.8	0.07	0.88
DB3	02	77	CL	0	0.2	99.8	22.1	77.7	0.00	0.28
DB3	3	100	SP	0	97.8	2.2			44.45	N/A
DB4	01	39	SP	0	98.4	1.6			61.50	N/A
DB4	02	89	SM	19.9	61.7	18.4	11.3	7.1	4.43	1.59
DB4	03	94	CL	0	0.8	99.2	17.9	81.3	0.01	0.22
GB1	04	15-17	SP/GP	44.6	50.6	4.8			19.83	N/A
GB1	10	37.5-39.5	SM	11.5	53.5	35			1.86	N/A
GB1	19	62.5-64.5	SP-SM	12.2	77.6	10.2			8.80	N/A
GB1	23	72.5-74.5	SP-SM	0.2	92.8	7			13.29	N/A
GB1	26	80-82	SP-SM	0.1	89.5	10.4			8.62	N/A
GB1	28	90-92	CL	0	2	98	36.5	61.5	0.02	0.59
W11R	01	60	SP-SM	23.7	71.2	5.1			18.61	N/A
W16R	01	39	SP	25.9	71.2	2.9			33.48	N/A
W18	01	50	SM	14.5	62	0	4.3	9.2		N/A
W18	02	75	SP	0	96.3	0	0	5.7		N/A
W22C	01	100	CL	0	0.3	99.7	48.7	51	0.00	0.95
W23B	01	76	CL	0.1	0.4	99.5	48.9	50.6	0.01	0.97
W28	01	30	SP-SM	24	70.3	5.7			16.54	N/A
W29	01	25	SP	1.6	96.5	1.9			51.63	N/A

NOTES:

- 1) USCS - Unified Soil Classification System.
- 2) Silt & Clay - Where only total value is given, the sum of the silt and clay-sized particles is presented here.
- 3) N/A = Not Applicable
- 4) Soil samples for W18 grain size analysis collected and analyzed by Warzyn in 1989.

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Results For Field Volatile Organics Screening - Soil Gas

**Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study**

[illegible]

TABLE 6-1 (Continued)

Sample ID	PID Reading		1,1,1-TCA	1,1-DCA	1,2-DCE	TCE	PCE	Toluene	Ethyl Benzene	Total Xylene	Comments
Former Fiber Spreading Area											
SG- 23	0	nd									
SG- 29	0	nd									
SG- 38	0	nd									
SG- 39	1-0	nd									
SG- 40	1-0	nd									
SG- 41	1-0	nd									
SG- 41 LD	-	nd									
SG- 42	2-0	nd									
SG- 106	0	nd									
SG- 128	2.5	nd									
SG- 129	1-0.2	nd									
Beloit Corporation Storage Yard Area											
SG- 21	2	nd									high humidity
SG- 24	0	nd									
SG- 25	0	nd									
SG- 26	0.5						2.5 J				
SG- 30	10-12	nd									high humidity
SG- 33	0	nd									
SG- 33 FD	0	nd									
SG- 34	0	nd									
SG- 35	0	nd									
SG- 43	1-0	nd									
SG- 43 FD	1-0	nd									
SG- 44	2-0	nd									
SG- 44 LD	-	nd									
SG- 105	0	nd									
SG- 107	8.5-8		13.9		0.49 J		27				
SG- 107 LD	-		13.8		0.502 J		26				
SG- 108	1.3						1.79 J				extra sample point
SG- 108 FD	1.4-0.7						3.08 J				
SG- 125	1-1.5		0.968 J				1.65 J	0.492 J			extra sample point
SG- 125 LD	-		0.984 J				1.76 J	0.443 J			
SG- 126	3-4		3.29 J				17.5				extra sample point
SG- 127	2.5		2.4 J				11.1				extra sample point
SG- 130	7.5-8						47.2	0.706 J			extra sample point
SG- 130 FD	8						50.3	0.279 J			
SG- 131	5-6		0.35 J				39.8				extra sample point
SG- 131 LD	-		0.32 J				38.4				

TABLE 6-1 (continued)

[illegible]

TABLE 6-1 (continued)

[illegible]

TABLE 6-1 (Continued)

Sample ID	PID Reading		1,1,1-TCA	1,1-DCA	1,2-DCE	TCE	PCE	Toluene	Ethyl Benzene	Total Xylene	Comments
SG- 67	not collected	-									renamed SG-212
SG- 71	not collected	-									access denied
SG- 72	not collected	-									access denied
SG- 73	not collected	-									renamed SG-204
SG- 74	not collected	-									renamed SG-208
SG- 75	not collected	-									access denied
SG- 79	not collected	-									access denied
SG- 80	not collected	-									access problem
SG- 82	not collected	-									access problem
SG- 83	not collected	-									access denied
SG- 85	not collected	-									access denied
SG- 88	not collected	-									access problem
SG- 90	not collected	-									access problem
SG- 91	not collected	-									access problem
SG- 109	not collected	-									not designated

All results are presented in ug/L concentrations.

PID Readings were taken with an Organic Vapor Monitor (OVM) equipped with a photoionization detector. Compound specific results are from the field GC equipped with PID and Hall detectors in series.

nd = Not detected. No compounds of interest present in this sample.

J = Concentration presented is below the reported detection limit of 5.0 ug/L stated in the method SOP.

x = Sample chromatogram contained unidentified peaks.

NA = Field GC analysis not performed on this sample.

- = duplicate PID reading not performed.

[Beloit.Diskette]RFIELD GC.xls

JAI-Mjh/jv/JEM

4/26/93

Results For Field Volatile Organics Screening - Groundwater

Beloit Corporation Blackhawk Facility

[illegible]

Results For Field Volatile Organics Screening - Groundwater

**Beloit Corporation Blackhawk Facility
Remedial Investigation / Feasibility Study**

[illegible]

TABLE 6-2

Results For Field Volatile Organics Screening - Groundwater

Beloit Corporation Blackhawk Facility
Remedial Investigation / Feasibility Study

Sample ID	Depth	Dilution factor (df)	Alkanes			Alkenes				Aromatics				Comments
			1,1,1-TCA	1,2-DCA	1,1-DCA	PCE	TCE	1,2-DCE	1,1-DCE	Benzene	Toluene	Ethyl Benzene	Total Xylene	
W23		(1:10)				2420								
W23		(1:100)				3630								
W23B-01	49'	(1:50)	35.3 J			2570	68.0 J	199 J						
W23B-01	49'	(1:100)				2510								
W23B-02	59'													ND
W23B-03	79'													ND
Grundfos Blk			0.8 J											
Water Truck														ND

All results are presented in ug/L concentrations.

ND = Not detected. No compounds of interest present in this sample.

J = Concentration presented is below the detection limit of 5.0 ug/L stated in the method SOP.

df = Dilutions were required for samples with compounds present at concentrations greater than the calibration range.

Sample specific detection limits are calculated as the detection limit (5 ug/L) times the dilution factor.

1 = Sample collected with a Grundfos pump. 1,1,1-TCA is a suspected pump contaminant.

TABLE 6-3

Results for Soil Boring Volatiles Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

	Alkanes		Alkenes	Ketones				Aromatics				Other	
	1,1,1-Trichloroethane	1,1-Dichloroethane	Tetrachloroethene	Acetone	2-Butanone	4-Methyl-2-pentanone	2-Hexanone	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Chloroform	Carbon disulfide
Foundry Sand Disposal Area													
BC-SUSB12-00													
BC-SSSB12-12	3	15											
BC-SSSB12-14		3											
BC-SUSB13-00				89									
BC-SSSB13-04													
BC-SSSB13-34													
BC-SSSB13-34D													
Soterion Oil/United Recovery Plant													
BC-SUSB08-00													
BC-SSSB08-02					76	5	10	4	3				11
BC-SSSB08-12					89	9	16	3	2				2
BC-SSSB08-12D					120	9	20						
Former Fiber Spreading Area													
BC-SSSB09-16													
BC-SUSB10-00													
BC-SSSB10-06													
BC-SSSB10-30													
BC-SUSB11-00													
BC-SUSB11-90													
BC-SSSB11-10													
BC-SSSB11-20													
Beloit Corporation Storage Yard													
BC-SSSB14-24													
BC-SUSG130-00			8	67									
Beloit Corporation Plant													
BC-SUSB15-22													
BC-SUSB16-00													
BC-SSSB16-22													
BC-SSSB20-03										8	250		
BC-SUSB21-00			4										
BC-SUSB21-90			3										
BC-SUSB21-09													
Rockton Excavating													
BC-SUSB17-00													
BC-SSSB17-16												1	
Abandoned Waste Water Treatment Pond													
BC-SUSB18-00													
BC-SSSB18-08													
BC-SSSB18-12													
Gravel Pit													
BC-SUSB19-00													
BC-SSSB19-14													
BC-SSSB19-32													
Background													
BC-SUW24-00													
BC-SUSG107-00				40									

This Table presents volatile compounds detected in soil samples from the Beloit Facility. All results are in mg/kg.

[Beloit.diskette]RSB-VOC.xls

Oracle/JAH/jah/jv/JEM

4/26/93

TABLE 6-4

Results for Soil Boring Semivolatile Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

	Phenols					Phthalates			Polynuclear Aromatic Hydrocarbons (PAHs)																					
	Phenol	2-Methylphenol	4-Methylphenol	2,4-Dimethylphenol	4-Nitrophenol	Di-n-butylphthalate	Butylbenzylphthalate	bis(2-ethylhexyl)phthalate	Di-n-octyl Phthalate	Naphthalene	2-Methylnaphthalene	Acenaphthene	Dibenzofuran	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene	Carbazole	Total PAHs		
Foundry Sand Disposal Area																														
BC-SUSB12-00								43																						
BC-SSSB12-12	190	170	250	170						1000	880	950	520	490	6400	990	1400	1100	1800	1200	3700	3700	2000	2200	3100	2400	870	34300		
BC-SSSB12-14			580	390				2100		3100	2100	3500	1400	2500	27000	4800	57000	51000	58000	54000	130000	130000	57000	57000	9200	73000	2500	721100		
BC-SUSB13-00								53							58		130	120	88	88	240	70	97	150		170		1191		
BC-SSSB13-04															120		160	110	66	59	83	83	48					727		
BC-SSSB13-34D																														
BC-SSSB13-34															130		83	82	36									331		
Soterion Oil/United Recovery Plant																														
BC-SUSB08-00																														
BC-SSSB08-02															260													260		
BC-SSSB08-12															330			250										580		
BC-SSSB08-12D															280													280		
Former Fiber Spinning Area																														
BC-SSSB09-16																														
BC-SUSB10-00								50	74																					
BC-SSSB10-30																														
BC-SSSB10-06																														
BC-SUSB11-00					100			68																						
BC-SUSB11-60								60																						
BC-SSSB11-10																														
BC-SSSB11-20																														
Beloit Corporation Storage Yard																														
BC-SSSB14-24																														
BC-SUSG130-00								110	150																					
Beloit Corporation Plant																														
BC-SSSB15-22																														
BC-SUSB16-00															860		1700	940	660	830	1200	1200	540	410				8140		
BC-SSSB16-22																														
BC-SSSB20-02										75		700	190	380	1500	310	1700	1300	380	310	430	430	230				110	8045		
BC-SUSB21-00					99			210	120			99		59	820	170	2500	1100	810	690	1700	1700	840	430	110	420	140	11588		
BC-SUSB21-90					60			460		62	38	390	110	230	2300	470	5000	2300	1800	1700	4700	4700	1700	480	140	260	310	26680		
BC-SSSB21-09																	68	52			45	45						198		
Reckton Excavating																														
BC-SUSB17-00						380	2000	190							320	75	520	330	250	270	320	140	240	240	68	250		3023		
BC-SSSB17-16																														
Abandoned Waste Water Treatment Pond																														
BC-SUSB18-00								58																						
BC-SSSB18-06								550																						
BC-SSSB18-12																														
Gravel PR																														
BC-SUSB19-00																														
BC-SSSB19-14																														
BC-SSSB19-32								720																						
Background																														
BC-SUSG107-00					100			200																						
BC-SUW24-00								52																						

This table presents air semivolatile compounds detected in the soil boring samples from The Beloit Corporation.
All results are in ug/kg.

[Beloit Diskette]RSB-SVOC.xls
Oracle/JAH/jah/JEM
4/28/93

TABLE 6-5

Results for Soil Boring Pesticide/PCB Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

	Pesticides				PCBs		
	Heptachlor	4,4'-DDT	Methoxychlor	Endrin Ketone	Aroclor 1248	Aroclor 1254	Aroclor 1260
Foundry Sand Disposal Area							
BC-SUSB12-00							
BC-SSSB12-12			130	25			
BC-SSSB12-14			150	21			
BC-SUSB13-00							25
BC-SSSB13-04							
BC-SSSB13-34	0.74	2.8					
BC-SSSB13-34D							
Soterion Oil/United Recovery Plant							
BC-SUSB08-00							
BC-SSSB08-02							
BC-SSSB08-12							
BC-SSSB08-12D							
Former Fiber Spreading Area							
BC-SSSB09-16	1.0	4.1					
BC-SUSB10-00							
BC-SSSB10-30							
BC-SSSB10-06							
BC-SUSB11-00							
BC-SUSB11-90							
BC-SSSB11-10							
BC-SSSB11-20							
Beloit Corporation Storage Yard							
BC-SSSB14-24							
BC-SUSG130-00							
Beloit Corporation Plant							
BC-SSSB15-22	0.65	2.8					
BC-SUSB16-00							11
BC-SSSB16-22	0.96	3.9					
BC-SSSB20-03							
BC-SUSB21-00						300	
BC-SUSB21-90							
BC-SSSB21-09							
Rockton Excavating							
BC-SUSB17-00							
BC-SSSB17-16							
Abandoned Waste Water Treatment Pond							
BC-SUSB18-00						350	
BC-SSSB18-08							
BC-SSSB18-12							
Gravel Pit							
BC-SUSB19-00					24		
BC-SSSB19-14							
BC-SSSB19-32							
Background							
BC-SUSG107-00							
BC-SUW24-00							

This table presents all pesticide/PCB compounds detected in the soil boring samples.
All results are in ug/kg.

[Beloit.Diskette]RSB-PPCB.xls
Oracle/JAH/jah/jlv/JEM
4/26/93

TABLE 6-6

Results for Soil Boring Metals Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation - Feasibility Study

	Al	Sb	As	Ba	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Hg	Ni	K	Se	Ag	Na	V	Zn
Foundry Sand Disposal Area																					
BC-SUSB12-00	5120		3.0	61.7	2.2	2510	7.7	5.7	5.5	7540	8.8	1910	365		6.4	463				16.3	26.6
BC-SSSB12-12	3770		3.0	36.8	3.0	2430	35.7	8.4	115	16400	24.6	4110	546	0.08	89.2	359					63.6
BC-SSSB12-14	3790		10.7	53.8	11.5	8300	60.4	16.8	311	51000	216	11400	1400		266	487	0.62			14.2	311
BC-SUSB13-00	5280		1.8	66.8	2.2	2880	7.1	5.5	6.8	8040	8.6	1880	412		6.4	471	0.71			15.3	25
BC-SSSB13-04	7530		2.7	64.3	2.2	13300	9.5	4.6	7.1	10300	6.2	8510	333		8.4	486		2.9		16.6	24.7
BC-SSSB13-24	3300		1.7	13.4	1.7	81700	5.2	3.1	5.9	7320	3.5	37900	250		8	616		2.1		10.7	21.4
BC-SSSB13-34D	3830		1.1	16.1	1.5	82500	17.2	3.6	7.5	7010	2.7	41600	252		9.4	773		2.4			15.7
Soterion Oil/Unfed Recovery Plant																					
BC-SUSB08-00	1990	13.0	4.4	64.1	13.4	31000	2650	163	66.3	59900	37.2	18000	281		171	207		5.4	997	894	755
BC-SSSB08-02	4900	70.5	24.1	216	53.6	2790	13100	731	295	284000	9.5	1730	1010	0.26	826	498		37.6		4170	59.6
BC-SSSB08-12	2730	94.0	22.2	167	62.3	5050	14200	1160	335	308000	13.7	2610	1140	0.07	929	300		40.7		4660	181
BC-SSSB08-12D	2430	63.1	25.5	132	46.1	11200	10600	696	246	226000	16.6	5960	884		656	274		27.4		3510	104
Former Fiber Spreading Area																					
BC-SSSB08-16	2230		1.0	11.7	1.0	76600	5.1	3.7	7.2	6960	1.7	38400	250		6.2	300		2.5		13.7	13.1
BC-SUSB10-00	12900		4.8	126.0	4.3	2460	19.3	8.1	9.8	16000	12.8	1990	681		13.4	1050				36.5	42.9
BC-SSSB10-06	1340		1.0	8.0	1.4	93100	3.7	3.7	3.1	3710	2.2	51900	144			239		2.5			8.4
BC-SSSB10-30	3670		1.0	18.2	1.9	76300	5.9	5	7.5	6790	3.4	33200	215		7.3	697					40.6
BC-SUSB11-00	6450		2.0	61.6	2.7	11000	8.6	5.2	9.3	8350	11.2	8440	361	0.35	10.7	589	0.63	2.9		19	33.5
BC-SUSB11-60	6540		2.0	67.2	2.7	4320	7.3	6.2	9.1	9360	10.6	2600	422	0.33	8	530				19	31.1
BC-SSSB11-10	2000		1.1	11.7	2.3	59900	2.9	5.1	23.5	13500	1.9	32000	306	0.05	6.4	224				17.3	23.9
BC-SSSB11-20	1500		1.0	6.0	1.0	76900	6		6.4	4670	1.6	37300	202		7.6	163					6.2
Beloit Corporation Storage Yard Area																					
BC-SSSB14-24	1400		1.2	7.8	1.4	88000	6.2	2.7	4.9	4790	2	45000	164		4.7	236					10.5
BC-SUSG100 06	6990		3.1	113.0	3.5	1240	41	8.1	7.2	12100	9	1320	561		10.4	576	0.46			24.5	35.6
Beloit Corporation Plant																					
BC-SSSB15-22	2010		1.5	13.7	3.5	46500	100	4.3	16.8	15700	2.6	25200	290		12.1	570					33.9
BC-SUSB16-00	1060		1.1	22.0	3.5	99700	73.4	4.1	20.4	16900	627	52500	284		60.2	307			466		119
BC-SSSB16-22	3690		0.7	20.6	1.3	47800	6.7	3	9.7	5860	4.3	28300	122	0.05	10.2	478		2.4		13.6	24.9
BC-SSSB20-03	1810	11.6	2.3	8.4	1.6	73900	7.5	4.7	6.2	6240	2.2	36900	174		4.9	270					11.6
BC-SUSB21-00	1130		2.6	17.0	2.7	155000	43.9	4.2	17	9580	9.5	60600	261		39.7	648					35.9
BC-SUSB21-90	1840		3.7	19.5	2.9	147000	40.5	4	22.9	10800	11.5	73900	270		33.6	724		2.5			48.7
BC-SSSB21-03	9290		3.0	94.2	2.6	1650	11.6	7.2	7.2	11800	7	1500	430		8.6	567				22.9	30.5
Rockies Excavating																					
BC-SUSB17-00	3590		3.5	75.3	6.0	67900	23.1	5.7	136	22200	69.5	37000	412	0.07	166	579				12.6	152
BC-SSSB17-13	1540		1.0	10.3	1.5	79200	4.6	2.9	5.7	4500	2.1	35600	212		6.7	266		3.4			12.4
Abandoned Waste Water Treatment Ponds																					
BC-SUSB18-00	3210		3.5	26.9	1.3	32000	5.4	3.6	10.5	5130	10	17400	198	0.28	8.1	292				11.2	27.6
BC-SSSB18-03	2320		0.9	16.1	1.3	16000	5.1	2.6	4.9	3640	3.3	9230	62	0.17		251					14.9
BC-SSSB19-12	4370		0.9	20.2	1.2	11900	5.7	4	6.4	5160	3	7840	52.2	0.66	6.7	410					
Gravel Pit																					
BC-SUSB19-00	5090		2.7	47.1	1.9	2720	5.1	4.7	12.8	8050	5.1	4390	295	0.16	6.6	356				14.6	22.7
BC-SSSB19-11	1210		1.1	5.0		40600	3.9	3.3	4.1	3230	1.7	19200	97.5	0.04		151					6.3
BC-SSSB19-32	1980		2.0	9.6	1.9	60600	5.1	3.2	5.5	4900	2.4	24200	150	0.65	6.2	354		2.3			16
Site Background																					
BC-SUSG157-00	1190		1.2	6.5	1.2	149000	4.2	3.1	4.4	4140	4.8	73500	246		7.1	306		2.5			24.4
BC-SUW24-00	6090		3.3	98.8	2.0	3760	7	5.2	7.5	8040	31	1410	422		8.7	712	0.53			16.9	37.3

This table presents all metals detected in soil boring samples collected during 1992 at Beloit Corporation.

All results are in mg/kg.

[beloit.diskette]RSB-MTL.xls

Oracle/JAH/eh/iv/JEM

4/26/93

TABLE 6-7

Results for Groundwater Organics Analyses

**Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study**

	Volatiles								Pesticides		Semivolatiles		
	1,1,1-Trichloroethane	1,2-Dichloroethane	1,1-Dichloroethane	Tetrachloroethene	Trichloroethene	1,2-Dichloroethene (1)	1,1-Dichloroethene	Carbon disulfide	Endrin aldehyde (2)	Heptachlor	Di-n-butylphthalate	Diethylphthalate	Dimethylphthalate
MCL	200	5	-	5	5	70	7	-	2	0.4	-	-	-
RDL	10	10	10	10	10	10	10	10	0.1	0.05	10	10	10
Shallow Wells													
BC-GWW03R-01	6		1	5 *									
BC-GWW19-01	2												
BC-GWW20-01	16					9							
BC-GWW21-01	22		2	31 *	19 *								
BC-GWW23-01 (3)				3000 *									
BC-GWG104-01	24		15	4	2								
BC-GWG109-01	5		3										
BC-GWG110-01				4					0.003				
BC-GWG110-91									0.003				
Intermediate Wells													
BC-GWW05R-01	45		7	12 *	3		3						
BC-GWW14-01									0.004				
BC-GWW22B-01								2	0.003				
BC-GWW20B-01	8			6 *	5				0.002				
BC-GWW20B-91	19		1	1		10	1		0.003				
BC-GWW21B-01	25				2				0.004			1	
BC-GWW23B-01 (4)	47	320 *		970 *	33 *						1	2	
Deep Wells													
BC-GWW18-01	4				24 *								
BC-GWW18-91	4				20 *								
BC-GWW22C-01									0.005				
BC-GWW25C-01	10				1								
BC-GWW26C-01	16				61 *					0.16	1	2	1

This table presents organics results for groundwater samples collected at the Beloit Corporation. No compounds were detected in the background wells. A blank indicates the compound was not detected. RDL is the reported detection limit. Values below the RDL are considered estimated. All results are in ug/L. MCLs are from the U.S.EPA SDWA.

* = MCL exceeded.

1 = MCL for cis-1,2,-DCE presented (results are for total 1,2-DCE).

2 = MCL for endrin presented.

3 = VOC analysis performed at 1 to 25 dilution (detection limits = 250 ug/L).

4 = VOC analysis performed at 1 to 5.6 dilution (detection limits = 56 ug/L).

TABLE 6-8

Results of Groundwater Metals Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

SAMPLE	Al	As	Ba	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Ni	K	Ag	Na	Zn	CN
MCL		50	2000	5		100		1300		15			100					200
SMCL	50								300						100		5000	
RDL	50	2	10	5	1000	10	10	10	20	3	1000	10	20	100	10	2000	10	5
Shallow Wells	E	E	E	E	E			E	E		E	E	E	E	E	E	E	
BC-GWW03R-01			23	5 *	87600						31400			780		7930		
BC-GWW13-01			69		103000						38600	13		1030	10	6610		
BC-GWW15-01	62		229		209000				98		86300	286	877 *	8540	11	447000	22	
BC-GWW16R-01			29		84300				21		38100			580		2760		
BC-GWW17-01			24		10300						40500	13		460		3700		
BC-GWW19-01			21		83800						35100			1160		7780		
BC-GWW20-01			22		99400						41200			760		7420		
BC-GWW21-01			28		72400						33200	35		600		2800		
BC-GWW22-01			30		78800						42500	23		1320		3230		
BC-GWW23-01			56		139000			15			68100	127	28	1650		10500		
BC-GWG104-01			26		91700				30		38400			870		13000		
BC-GWG109-01			25		87500				25		37100			1670		11100		
BC-GWG110-01		2.3	52		86100				536		37800	334		3000		22800		
BC-GWG110-91		2.5	56		85600				869		37100	367		2920		21300		
Intermediate Wells				E		E			E	E		E	E				E	
BC-GWW05R-01			14		72400					3.4	32000	36		650		5550		
BC-GWW14-01			25		10000						36800	138	305 *	1540		37300		
BC-GWW19B-01			22		90900				51		37600	266		1070		12700		
BC-GWW20B-01			18	5 *	89000						37800	150		710		3260		
BC-GWW20B-91			19		86000				58		36400	153		670		2960		
BC-GWW21B-01			14		65400						30100			950		2220		
BC-GWW22B-01			17		79000						44400			1010		3560		
BC-GWW23B-01			28		93300						43000	34		1040		27700		
BC-GWG103D-01			13		54000						31700			1920		4980		
BC-GWG108D-01			32		85700	15			97		39700	22	41	1170		1500	26	
Deep Wells									E									E
BC-GWW18-01			17		69800						33900			1070		5130		8
BC-GWW18-91			17		73300				32		34900			1100		4050		5
BC-GWW22C-01			18		73700						36700			1340		5110		
BC-GWW25C-01			15		70100						33600	16		1270		2820		
BC-GWW26C-01			27		62400						33500			1010		11900		9
Background																		
BC-GWW08R-01			30		83900						35100	85		1250		30700		
BC-GWW11R-01			16		77000						33800	26		1220	10	24600		
BC-GWW24-01			54	5 *	11300						56900	145		3590		8970		
BC-GWG107-01			33		95800						46900			800		7140		
BC-GWG107-91			29		94800						46300			770		6780	17	
Background Value			64.6	NC	142,873						64,942	204		4,249	NC	41,069		

This table presents groundwater metals results for samples collected from the Beloit Corporation-Blackhawk Facility during 1992. All results in ug/l. MCLs and SMCLs are from the U.S.EPA SDWA. RDL is the reported detection limit. * Indicates MCL was exceeded. "E" Indicates at least one well has a detected concentration exceeding the background value. Background values are calculated as the mean plus two times the standard deviation. "NC" Indicates statistical operations cannot be performed on a single value. Field duplicate BC-GWG107-91 was not included for calculations.

TABLE 6-9

Results for Groundwater Indicator Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

SAMPLE	Alk mg/L	Cl mg/L	SO4 mg/L	NO3+NO2 mg/L	NH3 mg/L	Phenolics mg/L	TDS mg/L	pH	Conductivity umhos/cm
Shallow Wells		E	E	E			E		E
BC-GWW03R-01	343	2	20	0.78			346	6.78	470
BC-GWW13-01	341	3		11.6			432	6.94	550
BC-GWW15-01	319	1100	56	0.33			2410	7.00	3,840
BC-GWW16R-01	333	4		0.48			338	7.07	445
BC-GWW17-01	388	4	25	0.21			384	6.64	550
BC-GWW19-01	284	15		8.7			360	6.95	600
BC-GWW20B-01	384	3		0.73			396	6.55	650
BC-GWW21-01	299	6	17	1.49			324	7.10	540
BC-GWW22-01	353	2	23	0.48			382	7.21	465
BC-GWW23-01	420	56	134	1.24			776	6.95	890
BC-GWG104-01	345	6		2.15			406	7.10	520
BC-GWG109-01	322	24		0.65			384	6.79	550
BC-GWG110-01	332	40		1.37			418	6.66	650
BC-GWG110-91	328	40		1.47			412	6.66	650
Intermediate Wells			E			E			E
BC-GWW05R-01	260	5	30	1.11			298	7.06	530
BC-GWW14-01	328	71	28	4.56			512	6.97	800
BC-GWW19B-01	341	34		0.03			412	6.85	670
BC-GWW20B-01	321	6		0.21			346	6.92	590
BC-GWW20B-91	327	6		0.19			348	6.92	590
BC-GWW21B-01	267	4	25	0.22			306	7.28	520
BC-GWW22B-01	354		24	1.05		0.02	384	7.13	470
BC-GWW23B-01	403	7	30	4.17			470	7.17	670
BC-GWG103D-01	236	3	24	3.92			286	7.70	355
BC-GWG108D-01	275	59	34	5.18			454	7.18	600
Deep Wells			E			E			
BC-GWW18-01	260	4	47	1.48			328	7.17	520
BC-GWW18-91	260	4	43	1.6			336	7.17	520
BC-GWW22C-01	305		25	1.24		0.01	340	6.93	435
BC-GWW25C-01	261	4	33	1.16			502	7.31	510
BC-GWW26C-01	256	3	45	0.7			332	7.14	550
BACKGROUND									
BC-GWW08R-01	272	86	19	1.25			430	7.38	732
BC-GWW11R-01	259	59	25	1.83			370	7.50	607
BC-GWW24-01	452	12		5.01			520	7.10	650
BC-GWG107-01	355	31	27	1.58			408	7.04	660
BC-GWG107-91	353	30	28	1.46			414	7.04	660
mean + 2sd	513	112	32.0	5.91			559		766

This table presents indicator results for groundwater samples from the Beloit Corporation. Conductivity and pH readings taken in the field.

"E" indicates background value for parameter exceeded in at least one sample from the group.

[Beloit.Diskette]RGW-IND.xls

Oracle/JAH/jah/jiv/JEM/RJR

4/26/93

TABLE 6-10

Results For Private Well Volatile Organics Analyses

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

Sample ID	Address	1,1,1-Trichloroethane	1,1-Dichloroethane	Chloromethane	Tetrachloroethene	Trichloroethene	1,1-Dichloroethene	Chloroform	1,4-Dichlorobenzene
MCL		200	-	-	5	5	7	100	75
BC-PW01-01	909 Watts				2			2	
BC-PW02-01 (1)	914 Watts	25			86 *		3		
BC-PW03-01	908 Blackhawk				0.7				
BC-PW04-01	910 Watts	19			29 *	0.5	2		
BC-PW07-01	1004 Watts	0.5							
BC-PW11-01	1310 Blackhawk							10	
BC-PW12-01	905 Watts			0.9	0.5			2	
BC-PW15-01	1204 Blackhawk							0.6	
BC-PW17-01	1314 Watts	0.8				0.5			
BC-PW19-01	1220 Blackhawk							2	
BC-PW20-01	1208 Blackhawk							0.9	
BC-PW21-01	410 Kile							2	
BC-PW25-01	1212 Blackhawk							1	
BC-PW34-01	1117 Watts	1	0.6			3			
BC-PW37-01	1012 Blackhawk	2	0.7		0.7	4			
BC-PW48-01	916 Blackhawk		0.7						
BC-PW50-01	1102 Blackhawk	9	3			14 *			
BC-PW51-01	407 Central				1				
BC-PW53-01	900 N. Prairie								0.6

This table presents organic compounds detected in private well samples collected from the Beloit Corporation -Blackhawk Facility RI/FS Site.

All results are in ug/L. The reported detection limit for all compounds is 1 ug/L.

MCLs are Maximum Contaminant Levels as established by the U.S.EPA SDWA.

* Indicates MCL exceedence.

(1) Due to concentrations of Tetrachloroethene exceeding the calibration range, a 1:4 dilution was required. Detection limits for PW02 are thus elevated 4 times to 4 ug/l.

[Beloit.Diskette]RPW-VOC.xls

Oracle/JAH/jah/jlv/JEM

4/26/93

TABLE 7-1

Summary of Physical and Chemical Properties of Chemicals of Potential Concern

Beloit Corporation - Blackhawk Facility
Remedial Investigation / Feasibility Study

COMPOUND	MW (g/mole)	Water Solubility (mg/L)	Density (g/cc)	Henry's Law Constant (atm-m ³ /mole)	Koc (ml/g)	Log Kow (ml/g)	Vapor Pressure (mm Hg)	Retardation Factor
Chloromethane	50	6.50E+03	0.92	4.40E-02	35	0.95	4.31E+03	1.2
Vinyl chloride	63	2.67E+03	1.37	8.19E-02	57	1.38	2.66E+03	1.3
Methylene chloride	85	2.00E+04	1.33	2.03E-03	8.8	1.30	3.60E+02	1.1
Acetone	58	1.00E+06	0.79	2.06E-05	2.2	-0.24	2.70E+02	1.0
Carbon disulfide	76	2.94E+03	1.26	1.23E-02	54	2.00	3.60E+02	1.3
1,1-Dichloroethene	97	2.25E+03	1.22	3.40E-02	65	1.84	6.00E+02	1.4
1,1-Dichloroethane	99	5.50E+03	1.18	4.31E-03	30	1.79	1.82E+02	1.2
1,2-Dichloroethene	97	6.30E+03	1.26	6.56E-03	39	0.48	3.24E+02	1.2
1,2-Dichloroethane	99	8.52E+03	1.25	9.78E-04	14	1.48	6.40E+01	1.1
2-Butanone	72	2.68E+05	0.81	2.74E-05	4.5	0.26	7.75E+01	1.0
1,1,1-Trichloroethane	133	1.50E+03	1.34	1.44E-02	152	2.50	1.23E+02	1.9
Trichloroethene	131	1.10E+03	1.46	9.10E-03	126	2.38	5.79E+01	1.8
Benzene	78	1.75E+03	0.88	5.59E-03	83	2.12	9.52E+01	1.5
4-Methyl-2-pentanone	100	1.70E+04	0.8	1.59E-02	20.5	0.88	6.00E+00	1.1
Tetrachloroethene	166	1.50E+02	1.62	2.59E-02	364	2.60	1.78E+01	3.2
Toluene	92	5.35E+02	0.87	6.37E-03	300	2.73	2.81E+01	2.8
Ethylbenzene	106	1.52E+02	0.87	6.43E-03	1100	3.15	7.00E+00	7.6
Total Xylenes	106	4.66E+02	0.9	7.04E-03	330	3.26	1.00E+01	3.0
Phenol	94	9.30E+04	1.07	4.54E-07	14.2	1.46	3.41E-01	1.1
1,4-Dichlorobenzene	147	7.90E+01	1.46	2.89E-03	1700	3.60	1.18E+00	11.2
2-Methylphenol	108	3.00E+04	1.03		500	1.97	2.40E-01	4.0
4-Methylphenol	108	3.00E+04	1.02	4.95E-04	500	1.97	1.10E-01	4.0
2,4-Dimethylphenol	122	4.60E+03 b	1.03		42	2.36	5.90E-02 b	1.3
Naphthalene	128	3.20E+01	0.96	1.11E-03	649	3.45	2.60E-04	4.9
2-Methylnaphthalene	142	2.70E+01	1.01		712	3.43	5.90E-02 d	5.3
Acenaphthene	154	3.42E+00	1.02	9.20E-05	4600	4.00	1.55E-03	28.6
Dibenzofuran	170	2.10E+01	1.09		820	3.51	2.00E-02 g	5.9
Diethylphthalate	222	8.96E+02	1.12	1.14E-06	142	2.50	3.50E-03	1.9
Fluorene	116	1.69E+00	1.2	6.42E-05	7300	4.20	7.10E-04	45
Phenanthrene	178	1.00E+00	0.98	1.59E-04	14000	4.46	6.80E-04	85
Anthracene	178	4.50E-02	1.28	1.02E-03	14000	4.45	1.95E-04	85
Di-n-butylphthalate	278	1.30E+01	1.05	2.82E-07	170000	5.60	1.00E-05	1,021

TABLE 7-1 (Continued)

COMPOUND	MW (g/mole)	Water Solubility (mg/L)	Density (g/cc)	Henry's Law Constant (atm-m ³ /mole)	Koc (ml/g)	Log Kow (ml/g)	Vapor Pressure (mm Hg)	Retardation Factor
Fluoranthene	202	2.06E-01	1.25	6.46E-06	38000	4.90	5.00E-06	229
Pyrene	202	1.32E-01	1.27	5.04E-06	38000	4.88	2.50E-06	229
Butylbenzylphthalate	312	2.90E+00	1.1		2430	4.15	8.60E-06	16
Benzo(a)anthracene	228	5.70E-03		1.16E-06	1380000	5.60	2.20E-08	8,281
Chrysene	228	1.80E-03	1.27	1.05E-06	200000	5.61	6.30E-09	1,201
bis(2-Ethylhexyl)phthalate	391	2.85E-01 a	0.98		692	4.91	8.60E-06 a	5.2
Di-n-octylphthalate	391	2.85E-01 a	0.99		692	4.91	8.60E-06 a	5.2
Benzo(b)fluoranthene	252	1.40E-02		1.19E-05	550000	6.06	5.00E-07	3,301
Benzo(k)fluoranthene	252	4.30E-03		3.94E-05	550000	6.06	5.10E-07	3,301
Benzo(a)pyrene	252	1.20E-03		1.55E-06	5500000	6.06	5.60E-09	33,001
Indeno(1,2,3-cd)pyrene	276	5.30E-04		6.86E-08	1600000	6.50	1.00E-10	9,601
Dibenz(a,h)anthracene	278	5.00E-04		7.33E-08	3300000	6.80	1.00E-10	19,801
Benzo(g,h,i)perylene	276	7.00E-04		5.34E-08	1600000	6.51	1.03E-10	9,601
Heptachlor	374	1.80E-01	1.58	8.19E-04	1.20E+04	4.40	3.0E-04	73.0
4,4'-DDT	355	5.00E-03		5.13E-04	2.43E+05	6.19	5.5E-06	1,459
Methoxychlor		4.00E-02	1.41					
PCB	328	3.10E-02		1.07E-03	530000	6.04	7.70E-05	3,181.0
Endrin Aldehyde	381	1.95E-01			1700		1.78E-07	11.2

Footnotes

- a = value estimated using butylbenzylphthalate
- b = value estimated using 2,4-dichlorophenol
- c = value estimated using benzene
- d = value estimated using 2-naphthylamine
- e = value estimated using DDT
- f = value estimated using dieldrin
- g = value estimated using diphenylamine
- h = value estimated using diphenyl ether
- i = value estimates using fluorene

TABLE 7-1 (Continued)

Definitions of chemical properties:

Water solubility is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. Values are given for a neutral pH and a temperature range of 20 degrees C. The rate at which a chemical is leached from a waste is a function of its solubility in water; more soluble compounds are expected to be leached more readily than less soluble chemicals. The water solubilities presented in literature indicate that the volatile organic compounds are more water soluble than most semivolatile organic compounds (e.g., PAHs and PCBs).

Vapor Pressure (VP) provides an indication of the rate at which a chemical in its pure state volatilizes. Values are given for a temperature range of 20 to 30 degrees C. VP is of primary significance where environmental interfaces such as surface soil/air and surface water/air occur. Chemicals with higher vapor pressures are expected to enter the atmosphere more readily than chemicals with lower vapor pressures.

Density refers to the specific density of a compound relative to pure water, having a density of 1.00. Compounds that have low solubilities and with a density greater than one would be expected to sink in water.

Henry's Law constant, or the compound's air-water partition coefficient, is important in evaluating air exposure pathways. Values for Henry's Law constants were derived experimentally or estimated as follows:

$$H(\text{atm-m}^3/\text{mole}) = \frac{\text{VP (atm)} \times \text{MW (g)}}{\text{Water Solubility (g/m}^3\text{)}}$$

Organic Carbon Partition Coefficient (Koc) is a measure of the tendency for organics to be adsorbed by soil and sediment, and is expressed as:

$$K_{oc} = \frac{\text{mg chemical adsorbed/kg organic carbon}}{\text{mg chemical dissolved/liter of solution}}$$

The Koc is chemical specific and is largely independent of soil properties. In general, Koc is inversely related to its environmental mobility. Koc is either determined experimentally or estimated as follows:

$$K_{oc} = (-0.55 * \text{Log Water Solubility in mg/L}) + 3.64$$

The octanol/Water Partition Coefficient (Kow) is defined as the ratio of the equilibrium concentration C of a dissolved substance in a two-phase system consisting of two largely immiscible solvents, in this case n-octanol and water:

TABLE 7-1 (Continued)

C_{octanol}
 $K_{ow} = \frac{C_{\text{octanol}}}{C_{\text{water}}}$

The K_{ow} is ideally dependent only on temperature and pressure. It is a constant without dimensions, and is given in the form of its logarithm to base ten. It is useful as a means to predict soil adsorption, biological uptake, and biomagnification. Values are either determined experimentally, or are estimated as follows:

$$K_{ow} = 4.5 - (0.75 * \text{Log Water Solubility in mg/L})$$

Retardation factors are calculated using the following equation:

$$R_f = 1 + (p_b/n) * K_d$$

where

p_b = aquifer bulk density (g/cm³) assumed 1.8 g/cm³

n = total porosity of the aquifer, assumed 0.3 (unitless)

K_d = distribution coefficient (mL/g) is calculated as $K_{oc} * F_{oc}$

and

F_{oc} = organic carbon content of soils, assumed F_{oc} is 0.1%.

Values were obtained from the following sources:

U.S.EPA Superfund Public Health Evaluation Manual (SPEM), 1986

[Beloit.Diskette]Chem.xls
JAH/jah/jlv/BJC/JEM

DRAWINGS



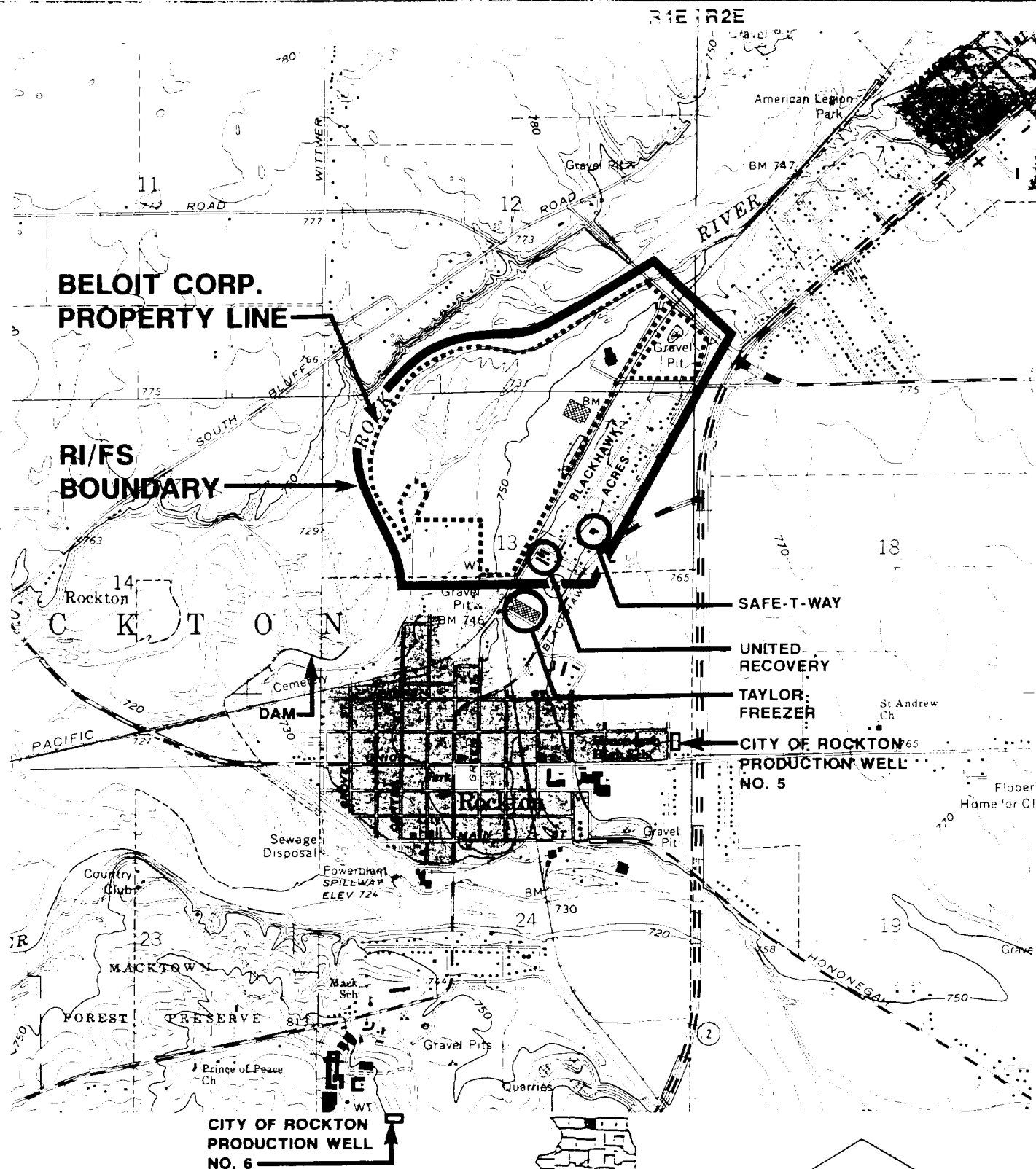
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Other

Technical Review
Project Manager KJD 10.15.92

Graphic Standards DLF 10.2.92
Lead Professional JEM 10.9.92

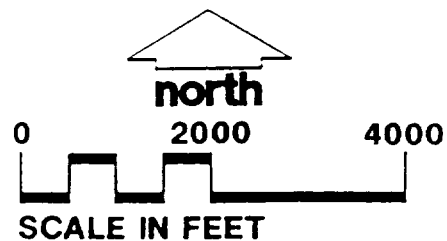
QUALITY
CONTROL

T46N



NOTES

1. BASE MAP DEVELOPED FROM THE SOUTH BELOIT, ILLINOIS-WISCONSIN, 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP, DATED 1971.



WARZYN INC. N68995

Developed By: JEM Drawn By: DLF
Approved By: [Signature] Date: 7/1/93
Reference:
Revisions:

SITE LOCATION MAP

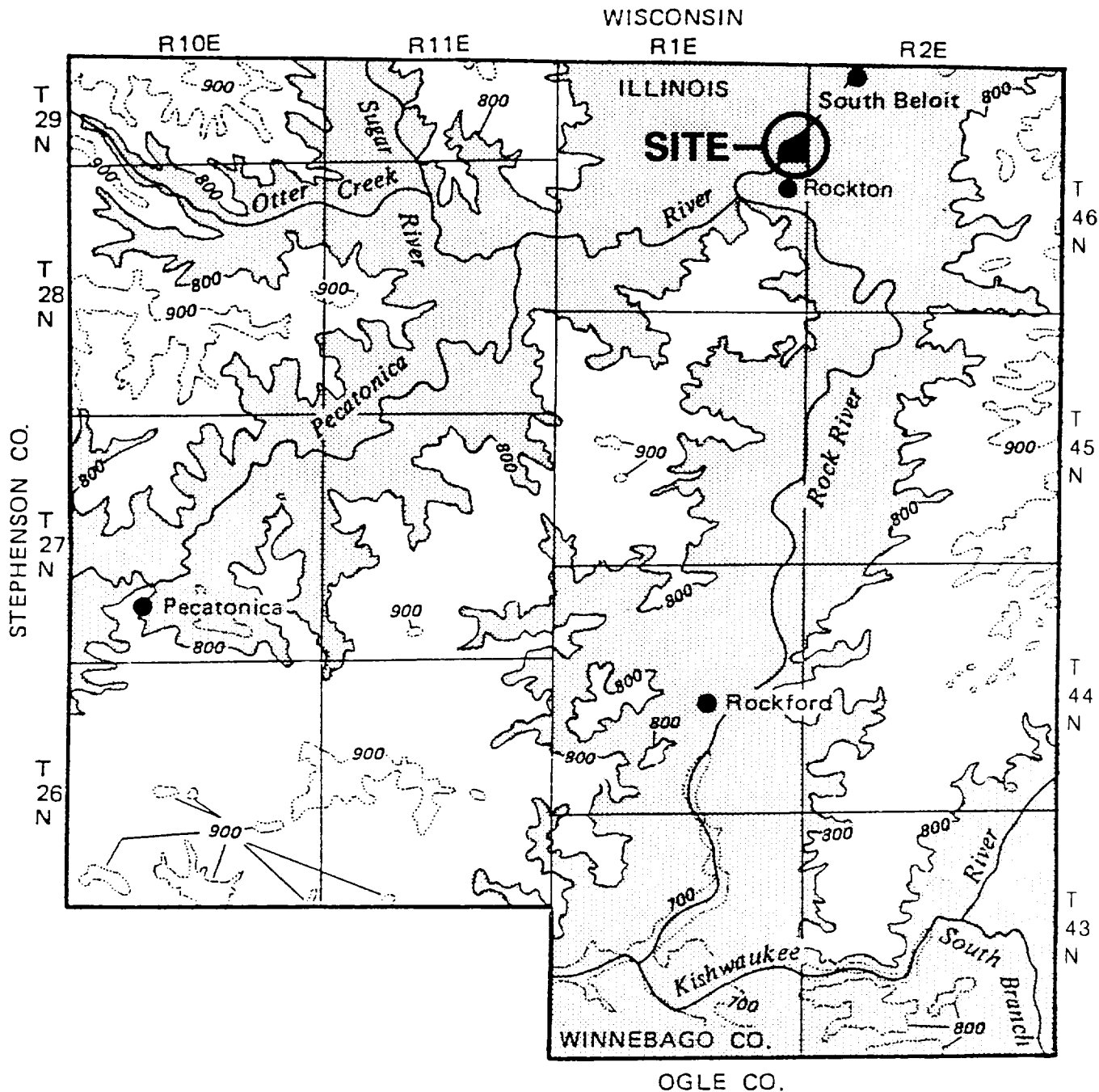
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BELOIT CORPORATION BLACKHAWK FACILITY
SECTION 12 AND 13, T46N, R1E
TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

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1526892 A1



QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other
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	JEM 10.9.92		



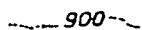
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ALLUVIAL VALLEYS



CONTOUR SHOWING SURFACE ELEVATIONS
AND BOUNDARY BETWEEN UPLANDS AND
ALLUVIAL VALLEYS



CONTOUR SHOWING SURFACE ELEVATION,
INTERVAL 100 FT



0 5
SCALE IN MILES

WARZYN INC. N68995

Developed By: *J.E.M.* Drawn By: *DLF*
Approved By: *Kevin Domack* Date: *7/1/93*
Reference:
Revisions:

SUMMARY OF SURFACE ELEVATIONS IN WINNEBAGO COUNTY*

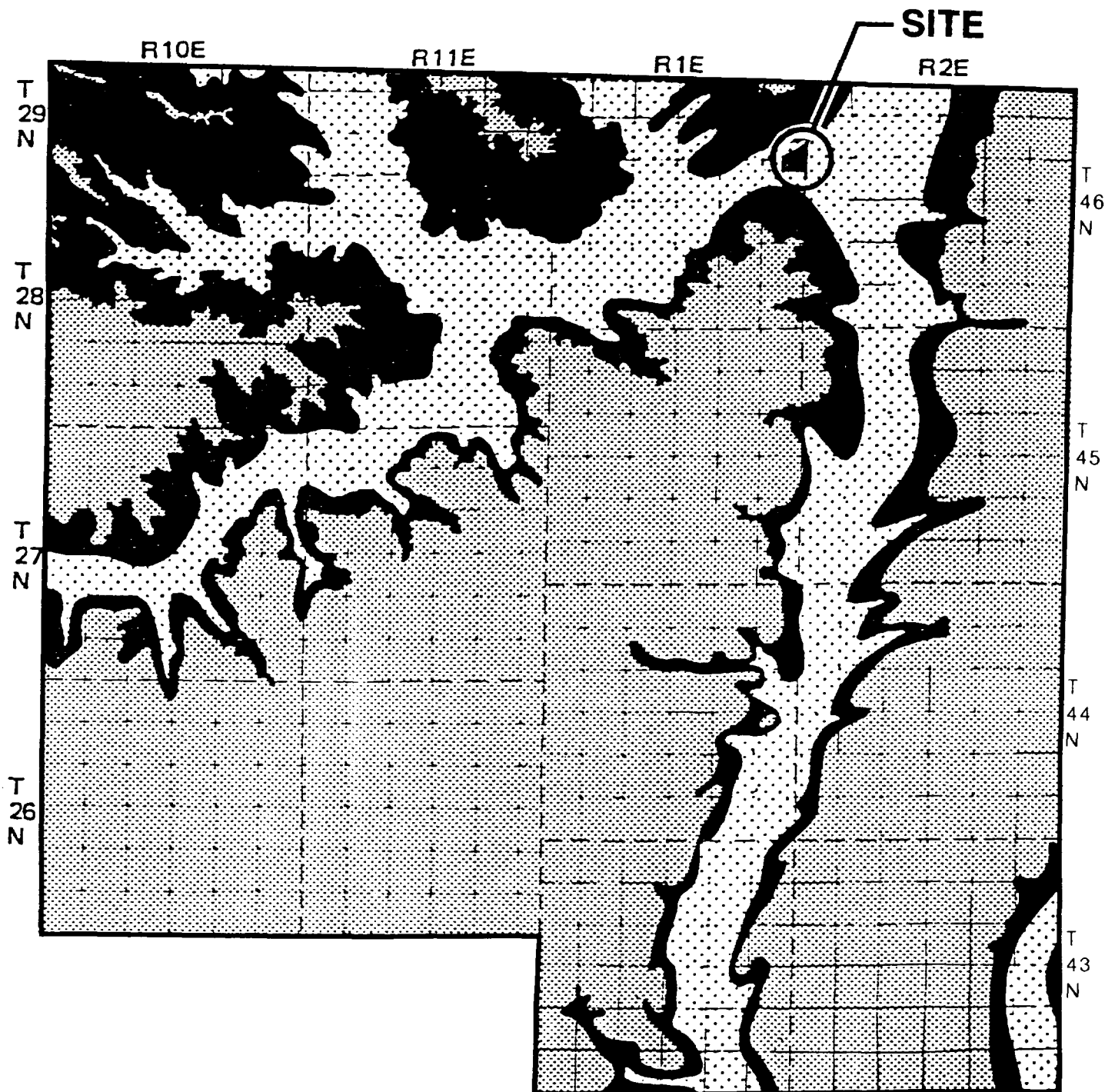
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SECTION 12 AND 13, T46N, R1E
TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

Drawing Number
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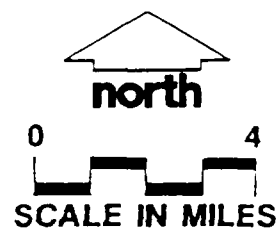
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Management Review
 Other
 Technical Review
 Project Manager KJD 10.15.92
 Graphic Standards DLF 10.2.92
 Lead Professional JEM 10.9.92
 QUALITY CONTROL



LEGEND

- GALENA GROUP
- PLATTEVILLE GROUP
- ANCELL GROUP



WARZYN INC. N68995

Developed By: J.E.M. Drawn By: DLF
 Approved By: Kevin Soucie Date: 7/1/93
 Reference:
 Revisions:

REGIONAL GEOLOGY OF THE BEDROCK SURFACE IN WINNEBAGO COUNTY *

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
 BELOIT CORPORATION BLACKHAWK FACILITY
 SECTION 12 AND 13, T46N, R1E
 TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

Drawing Number
 1526892 **A3**



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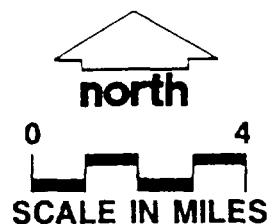
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 Other _____
 Technical Review _____
 Project Manager KJR 10.15.92
 Graphic Standards DLF 10.2.92
 Lead Professional JEM 10.9.92
 QUALITY CONTROL _____



LEGEND



CONTOUR INTERVAL 50 FT



WARZYN INC. N68995

Developed By: J.E.M. Drawn By: DLF
 Approved By: Kevin Somach Date: 7/1/93
 Reference: _____
 Revisions: _____

REGIONAL BEDROCK TOPOGRAPHY IN WINNEBAGO COUNTY *

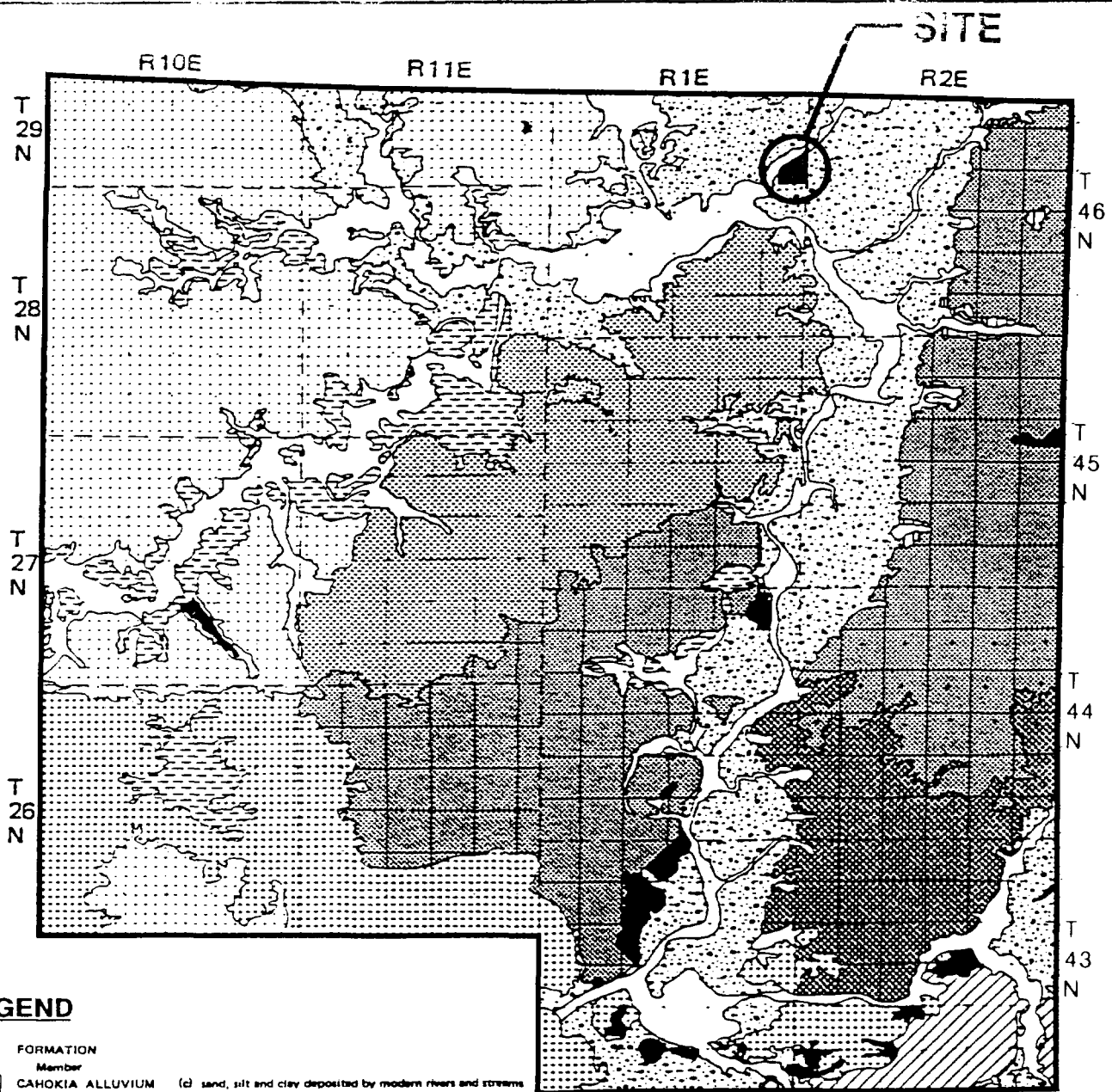
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
 BELOIT CORPORATION BLACKHAWK FACILITY
 SECTION 12 AND 13, T46N, R1E
 TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

Drawing Number
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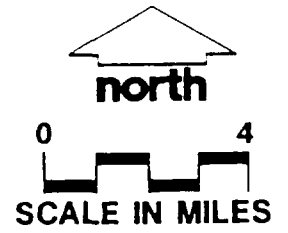
* (MODIFIED FROM BERG, KEMPTON, AND STECYK, 1984)

Management Review
 Technical Review
 Project Manager
 KJD 10.15.92
 Graphic Standards
 DLF 10.2.92
 Lead Professional
 JEM 10.9.92
 QUALITY CONTROL



LEGEND

FORMATION	
Member	
CAHOKIA ALLUVIUM	(c) sand, silt and clay deposited by modern rivers and streams
GRAYSLAKE PEAT	(gl) peat and muck often interbedded with silt and clay
EQUALITY	
Carmi	(ec) silt and clay deposited in glacial lakes
Dolton	(ed) medium-to-coarse sand deposited in former glacial lakes
HENRY	
Mackinaw	(hm) thick deposits of sand and gravel in major river valleys
Wesco	(hw) near ice deposits of poorly sorted sand and gravel
WINNEBAGO	
Capron	(wnc) pinkish-brown friable silt loam till
Clinton	(wnc) yellowish-tan, very friable, very sandy till
Argyle	(wa) pinkish or buff-tan often friable sandy till
Nimtz	(wn) gray-brown or buff often compact sandy or sandy loam till
GLASFORD	
Unnamed outwash	(g-o) sand and gravel deposit overlying Belvidere Till
Belvidere	(gb) pinkish or pale brown silty or silt-loam till
Esmond	(ge) grayish-brown silty clay till
Oregon	(gor) pinkish-brown or buff-tan sandy till
Creston	(gc) pinkish-brown silty clay loam till
Ogle	(gol) yellowish-brown or buff sandy loam till



WARZYN INC. N68995

Developed By: J.E.M. Drawn By: DLF
 Approved By: Curri Somach Date: 7/1/93
 Reference: _____
 Revisions: _____

**REGIONAL SURFICIAL GEOLOGY
 IN WINNEBAGO COUNTY ***
 REMEDIAL INVESTIGATION/FEASIBILITY STUDY
 BELOIT CORPORATION BLACKHAWK FACILITY
 SECTION 12 AND 13, T46N, R1E
 TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

Drawing Number
1526892 A5

WARZYN

* (MODIFIED FROM BERG, KEMPTON, AND STECYK, 1984)

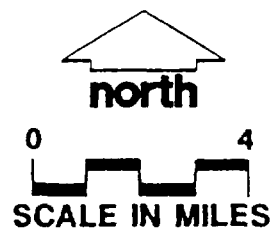
QUALITY CONTROL	Graphic Standards	DLF 10.2.92	Technical Review	Management Review
	Lead Professional	JEM 10.9.92		Project Manager



LEGEND



CONTOUR INTERVAL 50 FT, WITH
AUXILIARY CONTOUR AT 20 FT



WARZYN INC. N68995

Developed By:	J. E. M.	Drawn By:	
Approved By:	<i>John Domack</i>	Date:	7/1/93
Reference:			
Revisions:			

DRIFT THICKNESS IN WINNEBAGO COUNTY*

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
BELOIT CORPORATION BLACKHAWK FACILITY
SECTION 12 AND 13, T46N, R1E
TOWN OF ROCKTON, WINNEBAGO CO., ILLINOIS

Drawing Number
1526892 **A6**



* (MODIFIED FROM BERG, KEMPTON, AND STECYK, 1984)